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CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

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VOL. XLIII., No. 7. FRIDAY, AUGUST 16, 1907.

THE ELECTRIFICATION OF THE NEW HAVEN.

On July 24 the New York, New Haven & Hartford began running a few suburban trains out of New York with electric locomotives. This was the beginning of operation of the first system of single-phase alternating current electric traction for heavy steam railroad service in America. It is an experiment in the sense that it is new and untried in actual service of this kind, but it has been carried out on such a tremendous scale that it must succeed, because the railroad and the builders of the apparatus simply will not let it fail. There is published elsewhere in this issue of the *Railroad Gazette* an article by the Vice-President of the road in charge of engineering, who has had the supervision of the plans and work of electrification, which is illustrated with many photographs, and describes important features of the system. This article is of particular interest because it is the first authoritative statement of its kind, we believe, of the position of the New Haven on the much-discussed subject of electric traction for heavy railroad service.

The New Haven started its electrification plans with two narrow limitations. On the one side, whatever system was adopted must permit operating trains over the New York Central tracks from Woodlawn to Grand Central Station, and the Central had already begun to install 600-volt direct current, third-rail. This limited the consideration of systems to low-tension direct current identical with the New York Central apparatus and single-phase alternating current. Multi-phase alternating current and high-tension direct current systems, now well beyond the experimental stage in Europe, were out of the question. On the other side, the railroad company had to consider that whatever system of electric traction was to be adopted would sooner or later be extended over most, if not all, of the New Haven's present steam railroad system. There are a number of good reasons for this expectation. The mileage of the road is grouped closely together in a comparatively small territory; nearly half of its earnings come from passenger business and a large proportion of its freight is carried in small trains at a rate approximating the average passenger speed on many of the branch lines. Thus, as Mr. McHenry points out, it should be possible when electric traction is extended to operate various diverging lines each from central electric-producing stations serving a definite surrounding territory. There is a further reason, not far in the future, for the extension of electric operation. The consolidation of the New York, New Haven & Hartford and the Boston & Maine, now delayed, but in all probability delayed only by the restraining action of the Massachusetts legislature, will have particularly important results in its effect on terminal and suburban facilities at Boston. The thickly clustering lines owned either by the New Haven or the Boston & Maine leading into that city make this a peculiarly desirable field for electrification. President Mellen, indeed, has already promised to electrify along with the rearrangement and reconstruction of the present Boston terminals, once the consolidation is completed.

Mr. McHenry discusses the relative advantages and disadvantages of the two systems of electrical distribution in a fair-minded spirit, and shows how, all things considered, a single-phase alternating current system more nearly meets all the requirements of the present and further development of electric traction on the New Haven. It permits joint operation over the New York Central tracks out of New York, has a high efficiency of distribution over wide areas from power house to contact conductor and a high efficiency of consumption in the motors. The cost of installing and maintaining the apparatus and structures is little different from that required for a direct current installation, and the capacity of the locomotives and feeder lines is ample for the work to be done.

Another interesting point which is brought out is the standardization of power supply. The decision to use 25-cycle current instead of the more economical 15-cycle current was based entirely on commercial grounds. The standard frequency in nearly all street railway and electric lighting plants is 25 cycles, and in the event of breakdowns or other emergencies it was essential to be able to draw on outside sources for current. Furthermore, there was the advantage of future centralization of power supply for all the varied uses of such a railroad system as the New Haven. Now or later one central power house in each district can supply power not only for the electric service on the present lines of steam railroad and the street railways and interurban lines, of which the New Haven already controls some 1,500 miles as well, but for station lighting, station heating, small power plants for other uses and, provided the railroad company permanently retains the various lighting and power companies of which it became possessed as part of its Connecticut Railway & Lighting and other trolley purchases, the furnishing of power for these plants for local consumption in various towns and cities. Such centralization of the power supply of a given

district in one compact central station will result in great economies as soon as the scheme can be completely carried out—economies which should make up for a considerable part of the greater expense of heavy electric traction when first installed.

RULES AT THE END OF THE TONGUE.

In the Lackawanna coal mines each foreman henceforth must have the rules for safety at his tongue's end. Passing an examination when taking a job will no longer be sufficient; there will be a test every six months. The rules which these men have to memorize are not exactly parallel to railroad rules, and the catechising alone, even if it were more frequent than half yearly, would not in the railroad service insure safety; but this announcement of the coal mine manager* should be suggestive to railroad superintendents, nevertheless. The railroads of this country have made great progress since 1886, when they examined their men on rules very little, but most of them have great progress yet to make, if they are going to put their train service on a satisfactory basis. What conductor or engineman has even the more important rules of the standard code at his tongue's end? It may be said that such minute knowledge is not always necessary for safety. Granted; but it would greatly assist the examiner in gaining a knowledge of the employee's competency and reliability, and the teaching process would aid him in weeding out inefficient men. Compulsory half yearly study of rules would have a beneficial general effect, regardless of any improvement that could be specified in regard to any particular rule.

We advocate increased attention to rules—which already receive proportionately too much attention—because improvement in that feature could be expected to lead up to improvement in the other and more important one of increased attention to practice. Take, for example, the rule that conductor and engineman shall co-operate in checking train-registers, interpreting orders, and at other important junctures; after this rule has been revolved times enough in the minds of examiner and examinee they will begin to see more clearly the connection between the collision record and careless acts which could have been prevented by the correction of loose habits which are very common. Even the best conductors and enginemen, with rare exceptions, obey many of the rules loosely. We are not here asserting that the best men do dangerous things; the more competent they are, the more latitude can they take, in many situations, without danger; but they do omit precautions. Granting for the moment that such a course by a high-grade man usually is not an impairment of safety, the fact remains that the only safe course for the superintendent is to require exact compliance by all grades of trainmen. Only by being rigid with the good men can he enforce reasonable obedience among those who are not so good.

The requirement that conductors and enginemen shall jointly perform the most important acts incident to the movement of their train will be of less consequence as the block system comes more generally into use (unless the conductor rides in the cab); for the safety of the train, as regards its right of way, will depend more exclusively on the keeping of a good lookout at the forward end; but the joint-responsibility rule will not become a dead letter, for the block system has to be virtually suspended now and then, making it necessary that men in charge of trains shall know perfectly how to get them over the road promptly and safely without rules. The block system is not yet in use on all important lines—not to mention the less important—and in many cases where it is used some of its features are neglected or ignored. Apparently, American railroad officers and employees are to go through a long process of slow acquisition of knowledge by experience before they will come to depend as constantly and exclusively on the space-interval as they now depend (for the control of passenger trains) on the automatic air-brake; though it is certain that such complete dependence will be recognized eventually as the only safe and satisfactory plan.

Not the least attractive feature of this coal mine order is the promise of a reward for proficiency. In the enforcement of train rules the granting of a "trophy" would be looked upon probably as a measure too mild to be useful, but the principle is important. Every railroad superintendent who has paid premiums or prizes has apparently continued to have a favorable opinion of the practice; and yet it does not make headway. Why is such a simple means of arousing men's interest in their work so persistently neglected? Outside of the roadway department, where prizes, rewards and "honorable mention" have been used acceptably on a number of roads for many years, the employment of any kind of bonus is so rare that one has to search his memory to find any instances at all. Where it does not seem to cost anything, commendation of excellent service is favored; but why not make the matter a little more tangible? The recording of "merits" by the Atchison, Topeka & Santa Fe is highly commendable, but it is really only a beginning—a sample. Surely this is not the only way to show good will to employees. If tedious discussions with overbearing labor leaders about wages have come to take up so much of our railroad superintendents' time and energy that they have no time to cultivate and increase their good will for their employees, it is time that a few presidents stepped in and corrected the wrong tendency. The American railroad superintendent, in the management of his men, has to deal with some of the hardest problems known, and yet he everywhere neglects one of the simplest means of mitigating hard problems—the granting of special compensation for voluntary improvement or unusual effort by individual employees. To give a prize for having rules on the tongue's end would be a very simple thing. It might not produce real improvement in the service for some months or years. An improvement, when effected, might not be demonstrable, mathematically. Yet such a prize might be a useful stepping stone to something more detailed and definite, and could be made to lead to marked betterment of service. It will be highly discreditable to the railroads if coal mines are made safer than passenger trains!

School of Safety for Coal Mine Foremen.—Realizing that rules are readily forgotten unless constantly discussed, the Delaware, Lackawanna & Western has decided to hold competitive examinations every six months concerning the details of its coal-mine regulations. State mining laws and company's rules must be on the "tongue's end" of every mine foreman, fire boss, barn boss or driver boss. An examining board, consisting of the General Manager, his assistant, and the Chief Engineer, are to examine the men in a hall specially engaged for the purpose. To each man will be given practical questions to answer. The answers, recorded by a stenographer, will be carefully gone over and receive marks of relative merit. To the district showing the highest average for all men examined, will be awarded a handsome trophy which can be retained until the next competitive examination. If any district wins the trophy three times in succession, it is then to own it. Mine foremen and assistant foremen are examined by boards appointed by the State before receiving certificates which permit them to hold their position, but these examinations conducted by the company are intended to be supplementary to those prescribed by the State.

TRANSATLANTIC STEAMSHIP DEVELOPMENT.

We show this week, on another page, a very striking photograph of the new Cunarder, Lusitania, taken on her trial trip on the Clyde last month. To all persons who are interested in transatlantic navigation, the Lusitania is, and is likely for some time to remain, a peculiarly interesting vessel. She enjoys the transitory distinction of being the fastest and much the largest transatlantic steamship ever built. She is also the first transatlantic steamship to be fitted with four sets of engines driving four propellers (also two sets to go astern with), and these engines are turbines, developing 68,000 h.p., 26,000 more than that of any other vessel in the merchant service.

Besides these physical details, the most interesting thing about the Lusitania is the fact that she is a theoretic ship. The builders have had only moderate opportunity to study the workings of large turbine marine engines, and the work demanded of the Lusitania is so much heavier than that of any of the other three turbine steamers now in transatlantic service that the builders have been obliged to place entire reliance upon the calculations intended to meet a set of conditions largely new. The first turbine steamer to cross the Atlantic was the Victorian, of the Allan line, built in 1904 for the service between Liverpool and Montreal. She has been followed by a sister ship, the Virginian, and by the Carmania of the Cunard line, built in 1905. The Lusitania will, therefore, be the fourth turbine steamship in transatlantic service, although a considerable fleet of these vessels is now doing coastwise work in Great Britain and there are four upon our American coast—the Creole, of the Morgan line, between New York and New Orleans, and the Yale, Harvard and Governor Cobb, owned by Mr. Morse and his associates.

The gross tonnage of the Lusitania is 32,500, and the next largest steamer afloat, the Adriatic, of the White Star line, is approximately 7,500 tons smaller. The increases in gross tonnage, accompanied by changes in type, during the last 20 years have been so great and so significant that the topic is worthy of special notice. The Cunard line began its operations in 1840 as the pioneer among companies furnishing a regular steam service across the Atlantic, but during the next 48 years only one ocean steamship was built with a gross tonnage exceeding 10,000, and that was the famous Great Eastern (1858), which was 680 ft. long and of 18,918 tons, propelled by both paddle and screw, but with a maximum speed, seldom attained in actual service, of 14 knots, and with horse-power and design of engines totally inadequate to the task at

hand. As a result, the Great Eastern, as everybody knows, was a monumental failure.

In 1888, the Inman & International Company built the City of New York and City of Paris, of approximately 10,500 tons each, and these vessels remained the largest afloat until the Cunard line built the Campania and Lucania, in 1893. The latter were of 12,950 gross tons, and remained the largest on the ocean until 1897, when the North German Lloyd built the Kaiser Wilhelm der Grosse, of 14,349 gross tons. The first vessel of over 15,000 gross tons was the Oceanic, built for the White Star line in 1899 and having a gross tonnage of 17,274. The first vessel to exceed 18,000 tons was the Celtic, of the White Star line, built in 1901, and having a gross tonnage of 20,904. Since that time, approximately 16 vessels with a gross tonnage in excess of 18,000 have been built and a number of others are building.

Along with these increases in dimensions certain changes in type have also been developed. It may be said in general that the best transatlantic lines of steamers, from the earliest beginnings of steam navigation up to about 1896, were composed of vessels which were built for speed, the slower vessels on the line as a characteristic being older ships which were frequently record holders in their day. An instance of this may be found in the Cunard fleet at the time the Campania and Lucania were built, the next best vessels being the Etruria and Umbria, each of which at one time held the transatlantic record, while the older Aurania, Gallia and Bothnia were once famous as fast ships. Similarly, the best and most popular steamers of the North German Lloyd line in the north Atlantic service were small but fast vessels, each one of which had achieved a reputation for speed at the zenith of its career. Of course, the defect in a fleet of this kind from an economical standpoint was that each one of the older vessels burned altogether too much coal in proportion to the results gained. Beginning about 1896, therefore, a number of lines began building vessels of large carrying capacity and equipped with excellent passenger accommodations but capable of only a moderate speed. The Barbarossa, of the North German Lloyd line, with a gross tonnage of 10,915 and a speed of about 15 knots, was one of the first of these vessels, and they became so profitable that they became the characteristic carriers of the last decade. The four Red Star steamers, built between 1900 and 1902, had gross tonnages of about 12,000 and a speed of about 15 knots. The Holland-America fleet and the Atlantic Transport fleet were about the same size and the same speed. These boats were great earners, and their owners were quite content to allow the palm for speed to other lines willing to pay the very high price necessitated. As an example of the economy of this type of construction it may be noted that La Bretagne, built as a fast steamer by the French line in 1886, and having a gross tonnage of 7,010, burns slightly more coal per day than the Baltic, built as an economical ship of moderate speed, with a gross tonnage of 23,876, while the old Fürst Bismarck (Hamburg-American, built 1890; 8,430 tons) burned 300 tons a day, as against 140 tons burned by the President Lincoln (1907; 17,540 tons).

It is a striking fact, therefore, that in the 15 years of astonishing size development since the building of the Campania and the Lucania, no British steamer has been built to exceed them in speed in the transatlantic service. The two great German companies, the North German Lloyd and the Hamburg-American Packet, have found it profitable to maintain express steamers, perhaps in part for their advertising advantage, the North German Lloyd having four of these fast vessels now in operation and the Hamburg-American line, one. The Lusitania and her sister ship, the Mauretania, represent what is virtually a protest by the British government at having the ocean speed record held by Germans. To enable these new steamers to be built an arrangement was made by which the government virtually furnished funds to the steamship company at a cost of about 2½ per cent. to the company.

On her recent trial trip the Lusitania made a speed of approximately 25½ knots, and it is confidently expected that she will succeed in crossing the ocean in less than five days. It may be noted briefly that the first ship to cross in less than six days was the City of Paris, then of the Inman & International line, in 1889. The first ship to cross in less than seven days was the Alaska, of the Guion line, in 1882; the first to cross under eight days was the City of Brussels, of the Inman line, in 1869; and the first ship to cross under nine days was the Scotia, of the Cunard line, in 1862. The gross tonnage of the Scotia (paddle wheel) was 3,871; the gross tonnage of the Lusitania, as mentioned, is 32,500, and she has to burn about 1,000 tons of coal per day to make her contract speed. It has apparently not been proved that turbine steamers are more economical of coal than steamers with reciprocating engines, although the space saved gives them a material advantage and they are almost wholly free from vibration, a feature much appreciated by passengers. But a turbine engine of the present type (Parsons turbines are used on the Lusitania) cannot be driven astern; hence auxiliary turbines have to be used for manoeuvering. This has been a defect in existing ships; we have seen the Virginian require an hour to turn around in Lough Foyle, when space was limited and the tide was running. The manoeuvering problem, however, should resolve itself into a question of the power of the auxiliary turbines, and it is to be presumed that the Lusitania has profited by the experience of earlier builders.

NEW PUBLICATIONS.

American Railways as Investments. By Carl Snyder. 762 pages; 6½ x 9 in. Published by the Moody Corporation, 35 Nassau Street, New York. 1907. $3.20; by mail, $3.40.

Mr. Snyder, in his voluminous and in many ways comprehensive work, has the very laudable idea that the private investor in American railroad securities ought to have some other standard of comparison and basis of judgment than that furnished by *ex parte* statements from bankers and brokers desirous of selling certain stocks and bonds. In the introduction to his book he very properly points out the folly of buying from tips supplied by persons who are not disinterested in the course of the market, and he emphasizes the importance of forming independent conclusions of values, based upon the relation of capitalization and charges to earnings, after the management of a road and its general history and prospects are taken into account. Mr. Snyder shows the important difference between nominal and actual capitalization and gives a fairly good rule of thumb for determining true capital. To do this, he takes stocks and bonds outstanding, adds to them rentals, capitalized on a 4 per cent. basis, and subtracts from the result the value, as well as it can be obtained, of securities held as assets. He also calls attention to the importance of a careful consideration of a road's equities in the earnings of other properties and very properly cites the New York Central as an example of a road whose securities sell for a much higher price than is indicated by the actual excess of earnings over expenses, for the reason that it controls a group of highly prosperous subsidiary companies earning far more than they are dispersing in dividends, so that these dividends can be raised when the parent company needs a greater income, as was done this year.

The author calls attention also to the investigation of concealed earnings, that is, earnings which have been "plowed back" into the property, but we cannot agree with his comment, given as a note on page 66, to the effect that costs of material, etc., have so increased in the last year or so that there are, except in rare instances, no concealed earnings in the maintenance accounts of 1906 and 1907. This is obviously incorrect. It would be possible to cite an extremely large group of roads which have spent from 25 per cent. to 100 per cent. more than their strict requirements in maintenance of way and maintenance of equipment during the past year. We are also disposed to criticise the tabular statements of costs of maintenance of way per mile and of maintenance of equipment per mile, as given for each road discussed. The author makes it clear in his introduction that it is miles of single track and not route mileage which determines the cost of maintenance on the mile basis, and yet, in contradiction to his own rule of conduct, he uses the route mile throughout his work. The fallacy of estimating equipment maintenance on a mileage basis is too well known to need comment. Averages are queer cattle at best, and the only kind of an average that is of any use in a hasty comparison of equipment maintenance is an average based upon the numbers of each kind of equipment in use or upon the miles of service obtained from each engine and car. The author, so far as we have observed, does not even point out the most common pitfall of all to which the investigator of equipment and maintenance is subjected, that is to say, the fact that a very large number of roads charge renewals in the repair account without saying anything about it, while an equally large number carefully separate the two.

The general plan of the work is to take each of the principal railroads in the country and most of the smaller lines as well and give a rough outline of the principal facts in their respective developments, followed by a discussion of present ownership, of capitalization, of equities owned, character of traffic, stability of earnings, maintenance improvements from earnings, dividend record, balance sheet, and investment value, so called. A tremendous amount of material has been gathered together in this way and, even though the critical reviewer may find instances of loose work, such as have been cited, and methods of analysis which seem to him superficial, it is nevertheless true that the book is prolific in suggestions and is capable of material usefulness to the investor, provided he takes the author's own advice and forms independent conclusions, based upon the facts presented.

CONTRIBUTIONS

The Collision at Salem, Mich.

Bristol, Va.-Tenn., Aug. 7, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with interest your editorial in the August 2 issue of the *Railroad Gazette* in regard to the collision at Salem, Mich. Let me suggest that a ruled train order blank, similar to that used by a great many railroad companies, would probably have prevented this accident. If the train order had been put upon a blank of this kind and had been properly taken by the receiving operator the leaving time of the special would have been shown on a level with the word Salem, and in that event it is not likely that the engineer and conductor would have misread the order.

J. H. M'CUE.
Superintendent, Virginia & Southwestern.

Difficulties With Track Circuits.

Jamaica, N. Y., Aug. 5, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I was much interested in your timely editorial entitled "Track Circuits in Railroad Signaling," in your issue of July 26th. There is one phenomenon, however, on which you did not touch; the effects of metallic structures, such as bridges, acting as condensers to retard the pick-up of a track relay. In one especially noteworthy case of this that once came to my notice the retardation was so great that a fast passenger train would pass through two blocks before the first home signal would clear. I know of no remedy for this except cutting the circuits.

I have long been in favor of two track relays to a track circuit under certain conditions, but the battery should be placed in the middle of the section, with a relay at each end, the relays to be of equal resistance. No combination of two relays, however, will guard against dangers from foreign current. With one relay, one unbonded joint is liable to cause a clear failure; with two relays, it requires only two unbonded joints, or two broken rails a train length apart, to produce the same condition.

Likewise should we consider putting three or more relays in the circuit, the additional relay would only protect against one additional break in the circuit. Probably where A. C. track circuits cannot be used a great measure of protection could be secured by using stick relays, each relay to be restored by the one in advance.

W. H. ARKENBURGH.

Railroad Legislation of the Year.

As most conveniently summarizing the numerous and important statutes affecting railroads that have been adopted by state legislatures in the United States within the past 12 months we have made the following brief abstract of these laws, arranged by subjects. Important changes in railroad rates or practices which have been made in obedience to orders of state railroad commissions are also included, these in most cases having the force of direct legislative action. The compromises in North Carolina, Virginia and Alabama by which the principal railroads have complied with reduced-rate laws under protest are fresh in the mind of the reader. The new railroad law of the state of New York, in some respects more important than that of any other state, was printed in full in the *Railroad Gazette* of May 31, 1907. The other states which have passed general, comprehensive and radical railroad laws within the past year are Michigan, Oregon and Vermont.

PASSENGER FARES.

Alabama.—Roads 100 miles long or over 2½ cents a mile. For shorter roads the State Railroad Commission may prescribe rates. The commission is also to see to the introduction of interchangeable mileage tickets. The railroads secured an injunction against the enforcement of this law, but, following the compromise in North Carolina, the Southern Railway and at least one other have agreed to put the 2½-cent rate in effect pending litigation to settle the validity of the law.

Arkansas.—Two cents a mile; went into effect April 9.

Georgia.—The commission ordered the larger roads to reduce rates to 2 cents; other roads to 2¼ cents and still smaller roads to 2½ cents. This order was to go into effect September 2 next. One prominent road advises that no decision has yet been reached as to whether the law shall be complied with or be challenged in the courts.

Illinois.—Two cents a mile, all roads; went into effect July 1. Passengers paying fare in the cars may be charged 3 cents a mile.

Indiana.—Two cents a mile.

Iowa.—Two cents a mile on roads earning more than $4,000 per mile per annum; 2½ cents a mile on roads earning $3,000 per mile per annum; 3 cents a mile on smaller roads. Went into effect July 4.

Kansas.—No legislation concerning ordinary fares. Five-hundred mile tickets at 2 cents a mile required on all roads, and interchangeable 2,000-mile tickets at the same rate (net); went into effect May 1.

Michigan.—Two cents a mile on roads having passenger-train receipts of $1,200 per mile per year; 3 cents a mile on smaller roads; higher rates allowed on journeys of 10 miles or less. The rate on the main line of the Michigan Central has been 2 cents a mile for over four years past. The new law goes into effect September 27 next. The Detroit & Mackinac in one place will have to carry passengers 197 miles for $3.34, this being the rate by the shorter competing line.

Minnesota.—Two cents a mile; went into effect May 1.

Missouri.—Two cents a mile on all roads over 45 miles long; 4 cents a mile on shorter roads; went into effect June 19.

Montana.—New railroad commission required to "adopt" rates. Mileage tickets (3,000 miles) sold by large roads at 2½ cents.

Nebraska.—Two cents a mile; went into effect March 6.

New York.—New commission has power to prescribe rates.

North Carolina.—Two and one-quarter cents a mile on roads over 60 miles long; higher rates on smaller roads. The principal railroads secured an injunction against the enforcement of these rates, but they have this month agreed, under protest, to put the low rates in effect pending litigation to test the validity of the law.

Pennsylvania.—Two cents a mile; to go into effect October 1 next. The Pennsylvania Railroad has this year reduced to 2½ cents a mile all local passenger rates higher than that, making substantial reductions throughout its lines; and has introduced 1,000-mile tickets at 2 cents a mile, good for bearer.

South Dakota.—Railroad commission ordered to make valuation of railroads and then proceed to establish fares not over 2½ cents a mile.

Vermont.—New railroad commission has power to prescribe rates.

Virginia.—Two cents a mile on the principal roads; on other roads and on certain divisions of large roads higher rates are allowed, namely, 2½ cents, 3 cents, 3½ cents. The railroads secured an injunction against the enforcement of this law, but have agreed, under protest, to put the low rates in effect.

West Virginia.—Two cents a mile on roads over 50 miles long; on other roads 3 cents; went into effect May 21.

Wisconsin.—Two cents a mile on roads having over $3,500 receipts per mile per year. This goes into effect August 15.

The constitution of the new state of Oklahoma, not yet in effect, names a passenger rate of 2 cents a mile, but the railroad commission will have power to order increases if the low rate is found to be unjust.

RESTRICTION OF FREE TRANSPORTATION.

Alabama, Indiana, Iowa, Kansas, Michigan, Minnesota, Nebraska, Nevada, New York, Oregon, South Dakota, Texas and Vermont have passed prohibitory laws similar to that passed by Congress. In Nebraska monthly reports must be made to the state, and in Michigan yearly. In Nevada the classes excepted from the prohibition include teachers and students. The Texas law is more radical than any of the others. New Hampshire passed a law forbidding state officers to ride on passes and providing for an appropriation to pay their fares. In Oregon the persons excepted include judges and state officers; and a certain law passed to facilitate the appropriation of land by railroads, had a proviso that any road that desired to secure the benefit of the law must agree with the state to carry free the Governor, the members of the legislature and all the principal state officers.

FREIGHT RATES.

Alabama.—Rates in effect were made the legal maximum. Reductions were prescribed on over 100 commodities with a proviso for changes by the commission. The railroads have secured an injunction against the enforcement of this law, but the compromise which has been made concerning passenger rates probably will include some arrangement concerning freight rates.

Georgia.—Reductions ordered by commission some months since; order suspended by the courts; suits now pending.

Iowa.—The commission has this year ordered a reduction in rates on live stock, and a reduction of 20 per cent. in all joint through freight rates.

Kansas.—All grain rates reduced 15 per cent. This superseded certain changes made by the commission last year. Coal rates reduced by the commission (1906).

Michigan.—New commission (not yet in office) will have power to change freight rates. A law passed this year prescribing the procedure to be followed in securing rights of way has a proviso limiting certain carload freight rates.

Minnesota.—Many commodities were reduced 10 per cent.; but injunctions have been secured restraining the enforcement of the law.

Missouri.—Rates prescribed on apples, bricks, stone and certain other commodities. Commodity rates made in 1905 further reduced.

Nebraska.—Commission must make classification and fix rates. Legislature ordered a reduction of 15 per cent. on many commodities.

Nevada.—Legislature prescribed maximum rates much lower than those in effect, but new commission has power to change. Railroads have secured injunctions against enforcement of the law. Legislature prescribed rates on eight grades of ores. The Western classification was made the state classification.

New York.—New commission has power to prescribe rates.

North Carolina.—Reduction of 15 and 25 per cent. made in joint through rates; suspended by injunction.

Oregon.—Commission must see that a uniform classification is adopted.

Texas.—No recent legislation; but the commission, which has prescribed rates for several years has, within the past 12 months, made heavy reductions on the rates for many commodities. For example, Fuller's earth, formerly charged 34 cents for 250 miles, must now be carried that distance for 9 cents. The commission about a year ago ordered the adoption of the Western classification in Texas. On carpets and rugs rates have been reduced 40 per cent. On certain iron articles heavy reductions were ordered in rates to Galveston and certain other centers, but this was not a general reduction. Low rates were established on refined oils and heavy reductions were made in rates on green hides. The commission has ruled that freight wrongly described by shippers for the purpose of securing lower rates may be subjected to 10 per cent. increase on the proper rate as a penalty.

DEMURRAGE.

Alabama.—Reciprocal. Free time, 48 hours; but on many commodities 72 hours.

Colorado.—Reciprocal. Free time, 48 hours.

Indiana.—Reciprocal. Penalty, $5 a day.

Kansas.—Reciprocal. Penalty, $5 a day; free time on cars holding 30 tons, 48 hours; on larger cars, 72 hours.

Michigan.—New commission has power to prescribe rates.

Minnesota.—Reciprocal. Free time, 48 hours, except coal, lumber, etc., which are allowed 72 hours.

Missouri.—Reciprocal. Free time for cars holding 30 tons, 48 hours; larger cars, 72 hours.

New York.—New commission has power.

Oregon.—Reciprocal; commission may suspend.

South Dakota.—Reciprocal. *Texas.*—Reciprocal.

Vermont.—Reciprocal; severe conditions; free time four days.

Washington.—Reciprocal.

TARIFFS.

New tariffs must be posted in advance of the day they are to go into effect as follows:

Alabama	10 days.	New York	30 days.
Colorado	30 "	Oregon	10 "
Indiana	10 "	Vermont	30 "
Michigan	10 "		

SECRET RATES PROHIBITED.

Provisions like those of the Federal law have been enacted in Alabama, Colorado, Michigan, Nevada, New York, Oregon and Vermont. In Montana the new commission must prevent discrimination and extortion. Nebraska has prescribed heavy fines.

DISTRIBUTION OF CARS.

Fair distribution of freight cars is required under heavy penalties in Alabama, Indiana, Kansas, Michigan and Nevada. In New York the new commission has large powers in this matter. In Indiana and New York track connections must be built to private sidings wherever the commission may require.

JOINT PASSENGER STATIONS.

Railroads are required to provide suitable joint passenger stations at intersections in Alabama (where practicable), Michigan, Missouri and Oregon.

NEW RAILROAD COMMISSIONS.

New railroad commissions have been established as follows:

Alabama.—Three members, four-year terms, elected by popular vote.

Colorado.—New commission of three members. The railroads have begun a suit to enjoin the commissioners from exercising their functions. Law was to have gone into effect June 10.

Michigan.—In place of present single commissioner there is to be a new commission of three members; one a railroad lawyer and one familiar with transportation and traffic. For the third member no restriction is mentioned.

Montana.—New commission of three members, six-year terms.

Nebraska.—A new commission; appointees must be 30 years old.

Nevada.—New commission of three members, three-year terms.

New Jersey.—New commission of three members.

New York.—Old commission has been abolished. The state is divided into two districts, and for each district there is a Public Service Commission of five members having control not only over railroads, including street railroads, but also electricity and gas. The first district comprises New York City and the second all the rest of the state.

Oregon.—New commission of three members. These are to be elected, one at large and one from each of the two congressional districts.

Pennsylvania.—New commission, three members; to take office January 1, 1908.

Vermont.—In place of the old commission of three members a new one was established consisting of the same number. The Governor designates the chairman.

The commissions of Indiana, Washington and Wisconsin were established in 1905.

In Arkansas and Iowa the powers of the existing commissions have this year been materially enlarged.

WORKING HOURS.

Laws limiting the working hours of men having to do with the operation of trains, and of telegraph operators, have been passed in 12 states. We give a brief statement for each state, omitting the qualifying clauses, for which the reader will have to refer to the fuller reports heretofore published.

Connecticut.—Telegraphers, eight hours; small offices, 12 hours.

Indiana.—Trainmen, 16 hours. *Kansas.*—Trainmen and telegraphers, 16 hours. *Maryland.*—(1906). Telegraphers, eight hours. *Minnesota.*—Trainmen, 16 hours.

Missouri.—Telegraphers, eight hours; small offices, 12 hours.

Montana.—Trainmen and telegraphers, 16 hours.

New York.—Trainmen, 16 hours (March 4, 1908); telegraphers, eight hours (October 1, 1907); small roads excepted.

North Carolina.—Trainmen, 16 hours; telegraphers, 12 hours. Penalties for violation, fine and imprisonment.

South Dakota.—Trainmen, 16 hours. *Texas.*—Trainmen, 14 hours; telegraphers, 8 hours; small offices excepted. *West Virginia.*—(1906). Telegraphers, eight hours.

TRAIN CREWS.

The minimum number of men to be assigned to the management of trains has been prescribed by law in Arkansas, Indiana, Kansas, Texas and South Dakota.

EXPRESS COMPANIES AND PRIVATE CARS.

Express companies are brought under the regulative power of the state railroad commissions in Colorado, Iowa, Kansas, Michigan, Montana, Nebraska, Nevada, New Hampshire, New York, Oregon and Vermont. Private cars are brought under the regulative power of the commission in Colorado, Michigan, Montana, Nebraska, New York, Oregon and Vermont. The Colorado law specifies pipe lines and the Kansas and New York laws specify sleeping cars.

ACCIDENTS.

Railroad accidents are mentioned in recent laws as follows:

Colorado.—Commission to investigate.

Indiana.—Serious cases to be reported in five days; commission to investigate.

Minnesota.—Serious cases to be reported by telegraph. Commission to investigate if found necessary.

Montana.—Commission to investigate important accidents.

Nevada.—Accidents to be reported at once. Commission may investigate.

Vermont.—Serious cases to be reported by telegraph.

Washington.—Commission to investigate if any person killed. Monthly reports required same as those made to Interstate Commerce Commission.

EMPLOYER'S LIABILITY.

Laws extending liability of employers for accidents to employees, due to negligence of fellow employees, or accidents due in part to the victim's contributory negligence, have been passed in Iowa, Kansas, Nebraska and South Dakota.

MISCELLANEOUS.

The foregoing list embraces those subjects which have been most generally discussed and in which interest is felt throughout the country. In addition to these, there are numerous other matters of local importance which have been made the subject of legislation in one state or another within the past year. We note some of these.

Cabooses.—In Montana only eight-wheel cabooses may be run.

Confiscation of Coal.—Kansas, Montana and North Carolina have passed laws regulating the confiscation of coal by railroads. In Kansas and Montana the owner must be paid double the value of the coal. In North Carolina he must pay 125 per cent. of its value.

Express Rates.—Nebraska has passed a law reducing the rates for transportation of merchandise by express companies 25 per cent. The express companies have taken action in the courts to restrain the enforcement of this law.

Fences.—Iowa and Montana have passed laws requiring railroads to be fenced on both sides.

Frogs.—Missouri has adopted a law similar to that long in effect in many states requiring frogs and switches to be suitably blocked so that workmen shall not catch their feet in them.

General Powers.—Arkansas has passed a number of laws affecting the powers of railroad corporations, including one requiring that a general office shall be maintained in that state. In California a new law defines the rights of railroad corporations in regard to buying land, etc.

Headlights.—In Texas all train engines must have electric headlights.

Intoxication.—In Vermont a railroad company is now subject

to $3,000 fine for employing on trains men known to be dangerous on account of their drinking habits, and any person working in the train service and being intoxicated is liable to imprisonment for one year.

Lobbyists.—Nebraska has a law requiring legislative agents to be registered and to report their expenses.

Mercantile Business.—The new constitution of Oklahoma, not yet in effect, has a clause, like that in the Federal statute, forbidding railroads to transport their own products or manufactures except for their own use.

Penalties for Appealing.—Three states, Alabama, Arkansas and Missouri, have enacted laws designed to punish any railroad company which by appeal, or by any process, transfers to a Federal court any suit begun in a state court to enforce the laws of the state against the railroad.

Taxation.—In Nebraska a new law affecting local taxes increases the burden on the railroads of the state $500,000 yearly. In New Mexico there is a new law taxing sleeping cars. In Utah taxation is regulated by a new law, chapter 9.

Telephones.—In Montana railroads are required to allow all telephone companies to put up instruments in stations.

Train Rules.—An Indiana law requires the State Railroad Commission to see that the rules of the operating department of railroads shall be adequate and satisfactory. There is a provision for holding a convention of railroad men annually to consider this subject.

Safety Appliances.—We have made no mention of laws regulating safety devices—air-brakes, automatic couplers, grab irons, etc. Several states have passed laws of this kind, but as all are substantially similar to the Federal law on this subject, and as the practice of nearly or quite all of the railroads in every state now conforms to the Federal law, at least as well as it would conform to a state law, these new state statutes may be treated merely as confirmatory supplements to the Federal law. It is to be noted, however, that there are now three states in which the use of the block system is compulsory, on the order of the State Railroad Commission, namely, Indiana, Massachusetts and Minnesota. In Massachusetts this law has been in effect about a year but we have as yet heard of no mandatory order being issued. The state of Washington has provided for a safety appliance inspector at a salary of $2,000 a year. He must look after railroad safety generally. He may order dangerous cars out of service. The appointee must have had seven years' experience in railroad operation and must give a bond of $5,000 for the faithful performance of his duties.

In Nebraska night telegraph operators and towermen must be at least 21 years of age. In Minnesota the state commission must inspect and approve new railroads before they are put in use. The commission may require interlocking signals not only at crossings of one road with another, but also at junctions and drawbridges. In Illinois the law regulating the establishment of crossings has been revised.

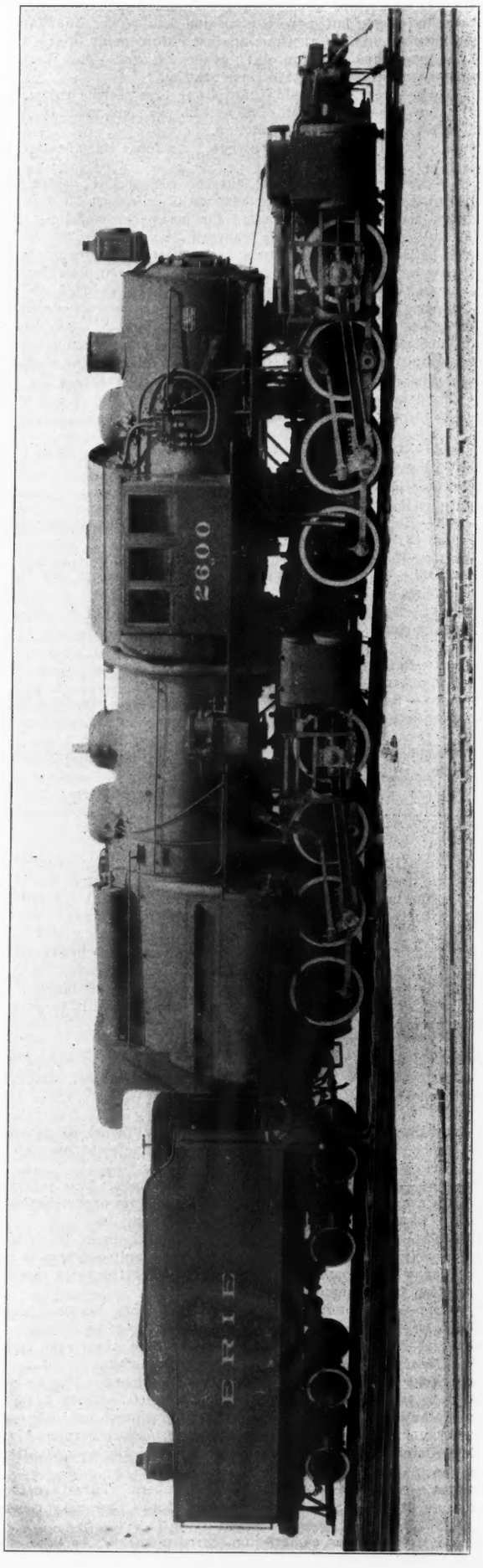
Mallet Compound Locomotive for the Erie Railroad.

The Mallet compound locomotive, introduced to American railroads three years ago in the monster that was built for the Baltimore & Ohio by the American Locomotive Company, has been so efficient from the start, both in economy of operation and maintenance, that its construction was followed closely in the engines of the same general type for the Great Northern illustrated in the *Railroad Gazette* of October 12, 1906; and then came the placing of an order for three of the original general type but of greater capacity for the Erie, to be used in pusher service on the 1.3 per cent. grade between Susquehanna and Gulf Summit, where, with a consolidation locomotive ahead, they will be capable of handling 2,660 tons. Although these Erie engines are much heavier and more powerful than the Baltimore & Ohio engine, the essential features of the two designs—such as flexible joints to high and low-pressure cylinders, receiver and exhaust pipes, articulated connection between frames, boiler, bearings, power reversing gear, etc., are practically the same, none of these features having failed to give perfect satisfaction during the two years this engine has been in continuous service.

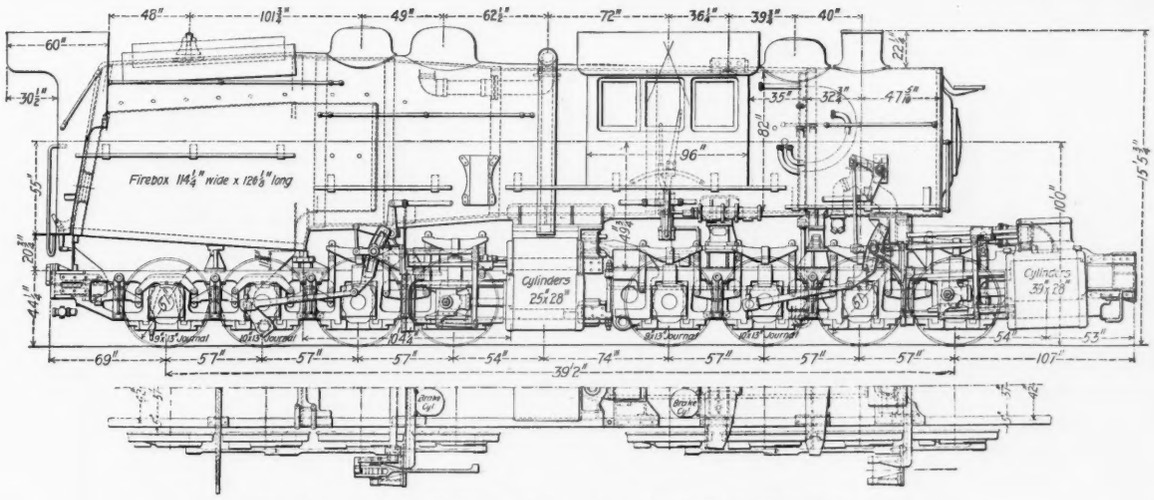
The accompanying tabular comparison will show the principle differences in the two designs:

	Baltimore & Ohio.	Erie.
Wheels	0-6-6-0	0-8-8-0
Total weight	334,500 lbs.	.....
Size of cylinders	20 & 32 x 32 in.	25 & 39 x 28 in.
Diameter of drivers	56 in.	51 in.
Tractive effort (working simple)	71,500 lbs.	94,800 lbs.
Steam pressure	235 "	215 "
Total wheel base	30 ft. 8 in.	39 ft. 2 in.
Driving wheel base, rigid	10 ft.	.....
Total heating surface	5,600 sq. ft.	5,313.7 sq. ft.
Grate area	72.2 "	100.0 "
Weight on drivers, tractive effort	4.78	.....
Total weight, total heating surface	599	.....
Trac. eff. x diam. drivrs, total htg surf.	700	910
Htg. surf., vol. equiv. simple cylinders	295	217
Grate area, vol. equiv. simple cylinders	385	408

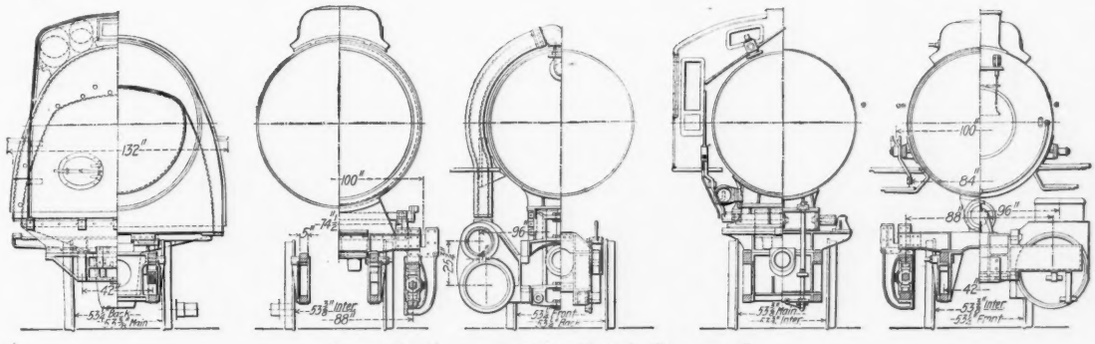
It must be noticed in comparing the above ratios that the engine illustrated is provided with a 4-ft. combustion chamber which decreases the total amount of heating surface; a point that will



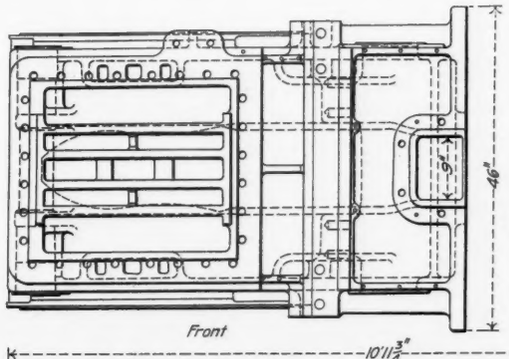
Sixteen-Wheel Mallet Compound Locomotive; Built by the American Locomotive Company for the Erie Railroad.

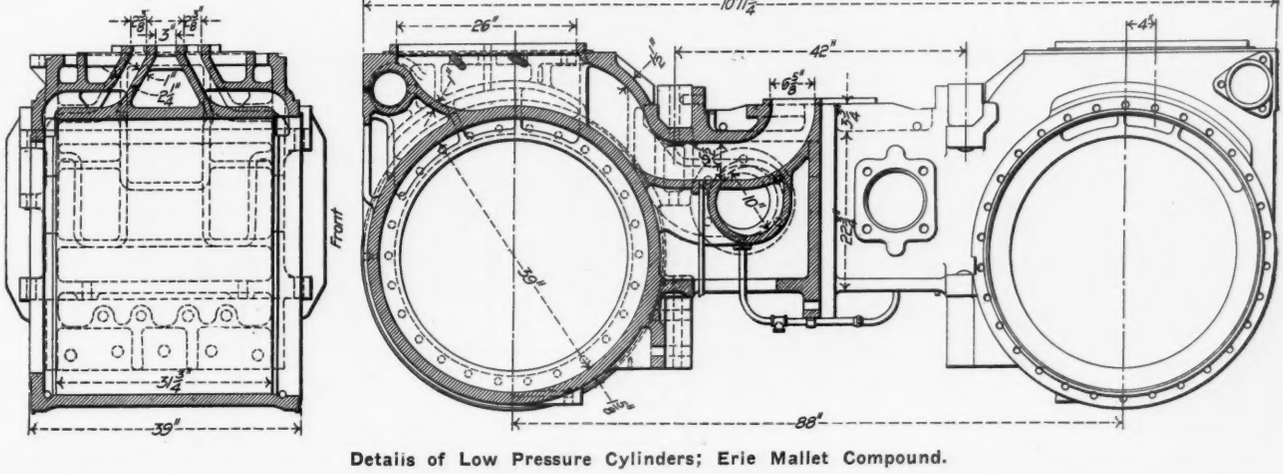


Side Elevation and Half Plan of Running Gear; Erie Mallet Compound.

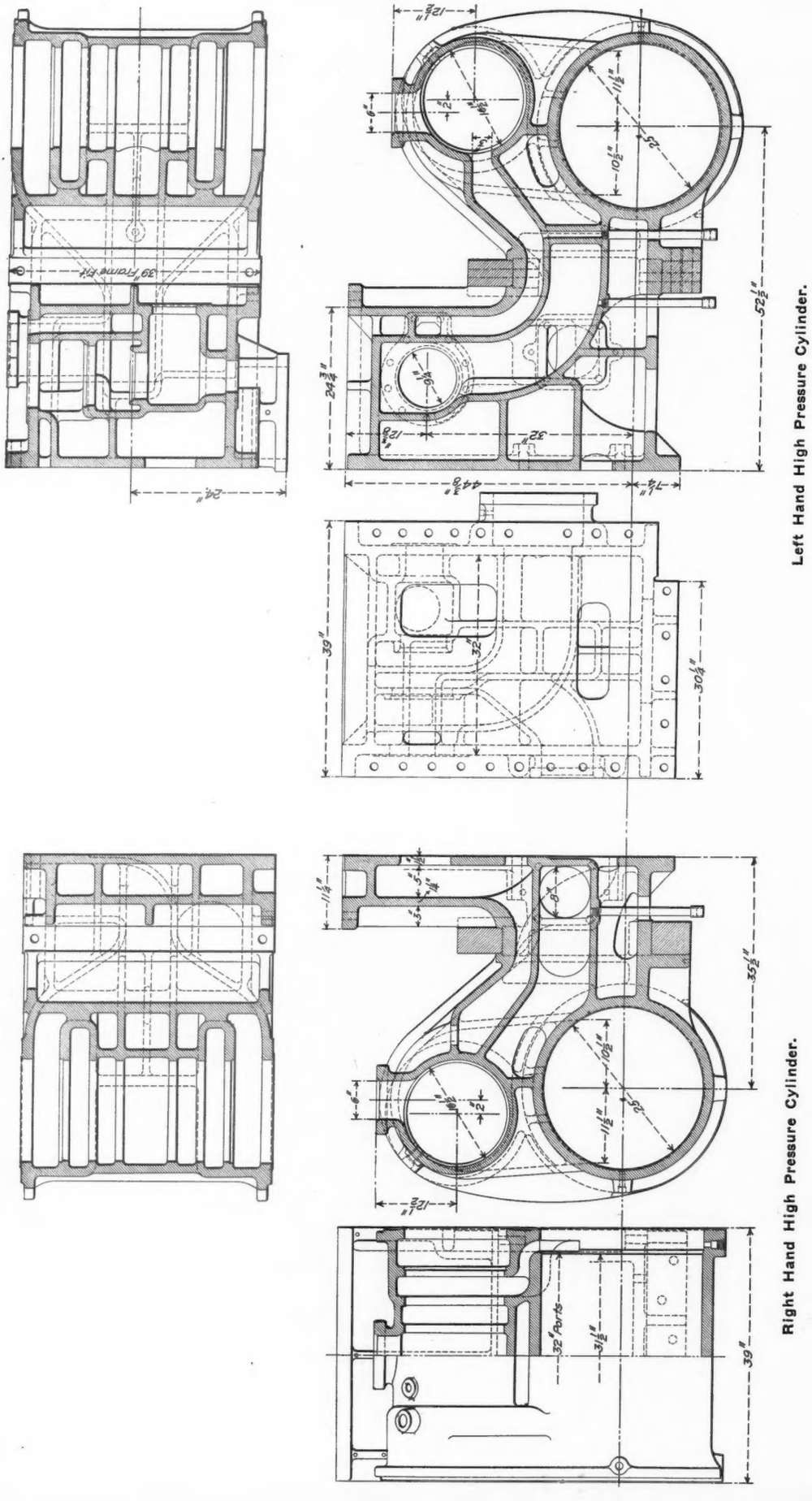


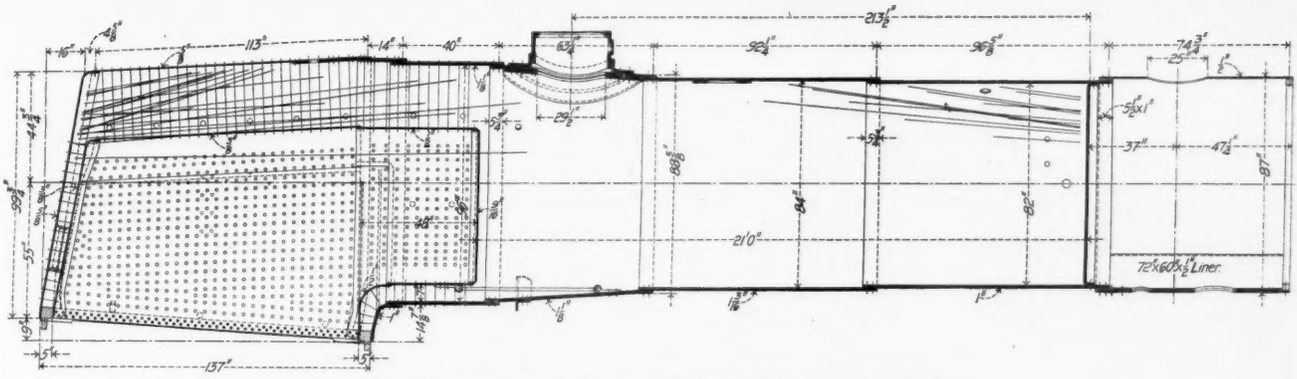
Cross Sections of Erie Mallet Compound.



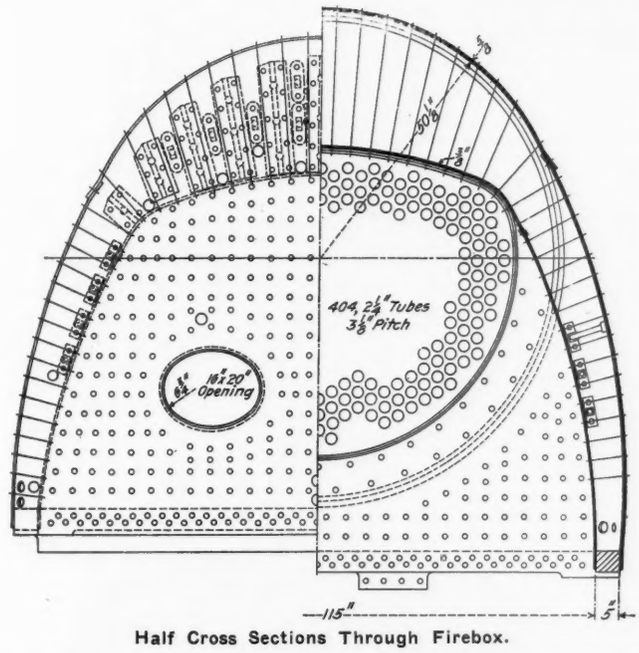


Details of Low Pressure Cylinders; Erie Mallet Compound.


39" Frame Fit
24"
12⅛"
11½"
10½"
6"
2"
10"
5"
25°
52½"
24¾"
10¼"
12⅛"
32"
44⅜"
7¼"
39"
32"
30¼"
Left Hand High Pressure Cylinder.
11½"
5"
¼"
5"
8"
35½"
10½"
6"
2"
11½"
25°
12⅛"
32" Ports
31½"
39"
Right Hand High Pressure Cylinder.



Longitudinal Section Through Boiler of Erie Mallet Compound.

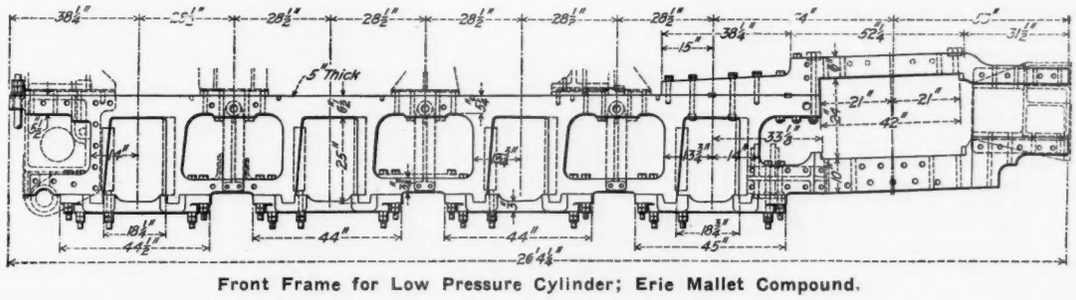


Half Cross Sections Through Firebox.

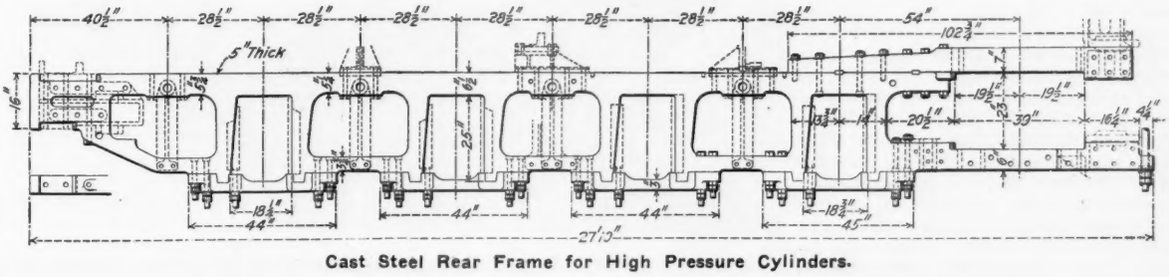
be discussed later. The weight of the Baltimore & Ohio engine was 334,500 lbs., which was carried by three pairs of driving wheels. This has been increased to 410,000 lbs. in this case; which necessitated the introduction of one more pair of wheels in each unit, thus increasing the total number to 16, by which means the load per wheel has been reduced to about 25,600 lbs., which is well below the limit set by a number of other road engines in service. The fact that this has been done is regarded by the builders as an argument showing the advantage of this type for obtaining a maximum adhesion for tractive power with a minimum rail pressure per wheel.

Of course in an engine of this size the point vital to its successful operation is the boiler. In this case the largest locomotive boiler ever built is used. It is of the radial stayed type with conical connection, the inside diameter of the first or smallest course being 82 in., while the inside diameter of the largest course is 96 in. The heaviest ring of the shell is $1^3/_{16}$ in. thick. This is also the thickest plate that has been used, and is needed for carrying the pressure of 215 lbs., which is also well up to the upper limit of what has been used in locomotive practice. The water alone in the boiler weighs 42,700 lbs., and the tubes, of which there are 404, 2¼ in. outside diameter and 21 ft. long, weigh 23,700 lbs. The total weight of the boiler with water is 139,900 lbs. The firebox is of the Wooten type, 120⅛ in. long and 114¼ in. wide, and has a grate area of 100 sq. ft. The water space at the mud ring is 5 in. on all sides. Aside from these dimensions the boiler has little about it of striking novelty, beyond the use of a cast steel dome; which, while not entirely new, is still sufficiently uncommon to attract attention. It was placed where it is, at the center of the length of the boiler, in order to avoid the possible disadvantages that might arise, due to the working of the engine in both directions, if it were near one end. It is on the conical course. It will be noticed that the conical course is lighter than the front, and is 1⅛ in. thick; still with the dome base and the stiffening ring for the opening there is an impressive mass of metal 3⅜ in. thick at the top. This is not far from the width of many foundation rings, and serves to account for the great weights noted above.

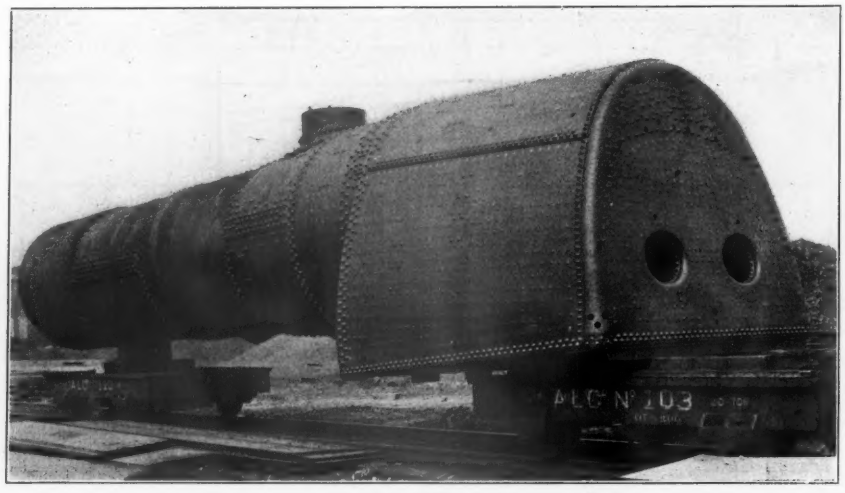
The cutting down of the actual amount of heating surface as compared with the smaller engine of the Baltimore & Ohio is another tribute to the demonstrated efficiency of the combustion chamber. By equating the heating surface of the two engines, it will be found that the Baltimore & Ohio engine had a total equated firebox heating surface of 1,369 sq. ft., while the Erie has 1,428.7 sq. ft., showing that, on the basis of the Vaughan formula, an allowance has, in reality, been made for the increased size and capacity of the engine. Attention is again called to the location of the injector check, which, on this boiler, is set only 8 in. back



Front Frame for Low Pressure Cylinder; Erie Mallet Compound.



Cast Steel Rear Frame for High Pressure Cylinders.

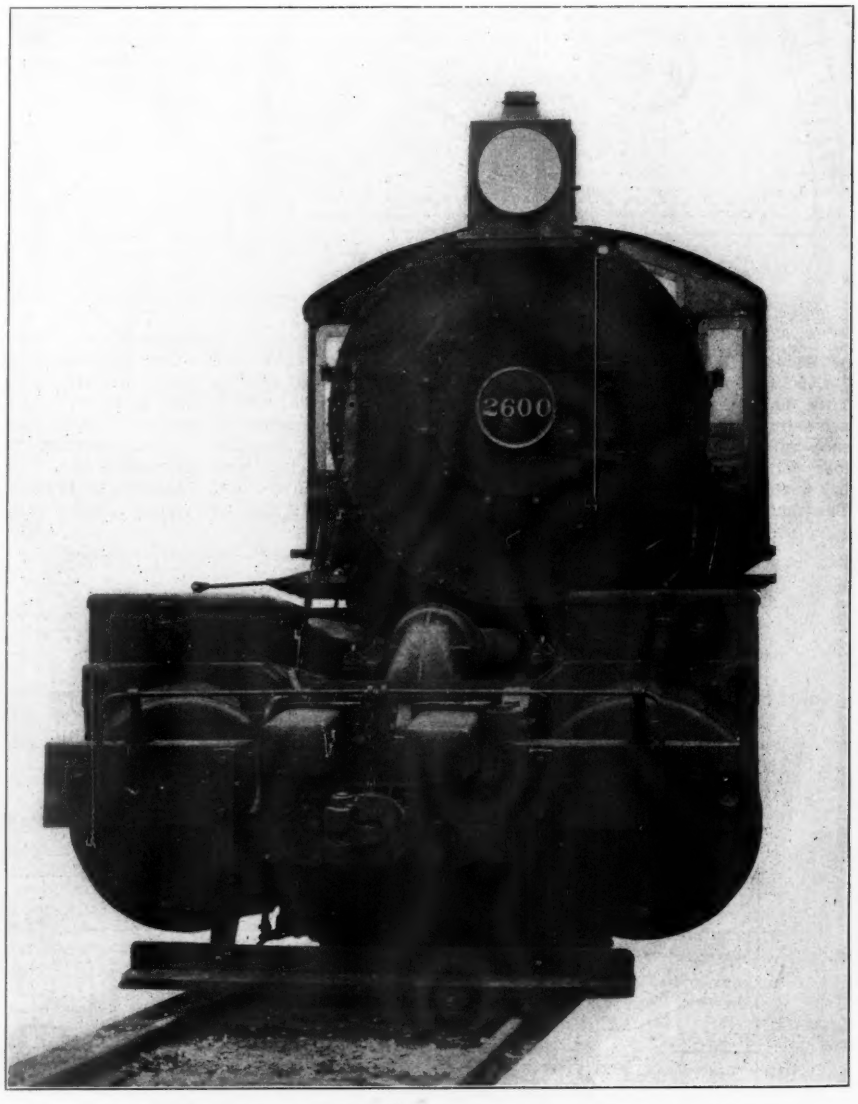


Boiler for Erie Mallet Compound.

of the front tube sheet and is nearer than in any other boiler yet shown in the *Railroad Gazette*. In the construction of the firebox and combustion chamber, sheets ½ in. thick are used for the latter, and the ordinary thickness, ⅜ in., for the crown and side sheets. The crown sheet drops 5½ in. in its slope from front to back.

The throttle valve is of a peculiar and somewhat novel construction. The great height of the top of the boiler above the rail (14 ft. 7½ in.) necessitates the use of a very low dome, and this in turn makes it advisable to take steam from the top of the same. The throttle valve has therefore been designed with this end in view; and, while it is balanced in the usual manner, steam is taken from the highest and dryest part of the dome only. To accomplish this the throttle casing A is surmounted by a crown piece B that curves in and beneath the overhang of the hood C that is fastened to the top of the valve and moves with it. The valve is hollow and is closed at the bottom by a piston $8^{11}/_{16}$ in. in diameter. This piston is furnished with water packing grooves and moves in a cylinder bored in the casing. Steam is admitted at all times to the top and interior of the valve through the space between the crown B and the hood C, a space which is never less than ¼ in. This arrangement serves not only to take the steam from near the top of the dome but also acts as a separator. This last feature is due to the fact that it is a tendency of steam under pressure and flowing rapidly over a concave surface, to deposit its contained water under the influence of centrifugal action on that surface. The water so deposited follows along past the upper lip D of the opening to the valve interior and thence down through the central space around the stem to the water in the boiler. Steam is led from the throttle pipe through a short dry pipe to a point directly in line with the high-pressure cylinders, from whence it passes through the top of the shell and is divided in a tee-pipe and passes down through wrought iron steam pipes on either side of the boiler to each of the high-pressure valve chambers. The design of the high-pressure cylinders which is shown in the accompanying illustration is similar to that used on the Baltimore & Ohio engine, the cylinders being cast in pairs with saddles, and the separation between the two cylinders being 8½ in. to the right of the center line of the saddle, to make room for the receiver pipe. The engines are compounded on the Mellin or Richmond system, the intercepting valve being located in the upper part of the left cylinder casting. Exhaust steam from the right high-pressure cylinder passes through a cored passage to the back of the cylinder casting, from whence it passes through an outside U-shaped pipe connecting to a passage in the left cylinder casting leading up into the intercepting valve chamber into which the exhaust steam from the left high-pressure cylinder also passes. The emergency exhaust valve is located in the side or the left cylinder casting and has a 4½-in. jointed pipe connection with an opening in the back of the exhaust pipe in the smokebox. A three-way cock within easy reach of the engineer operates the emergency exhaust valve.

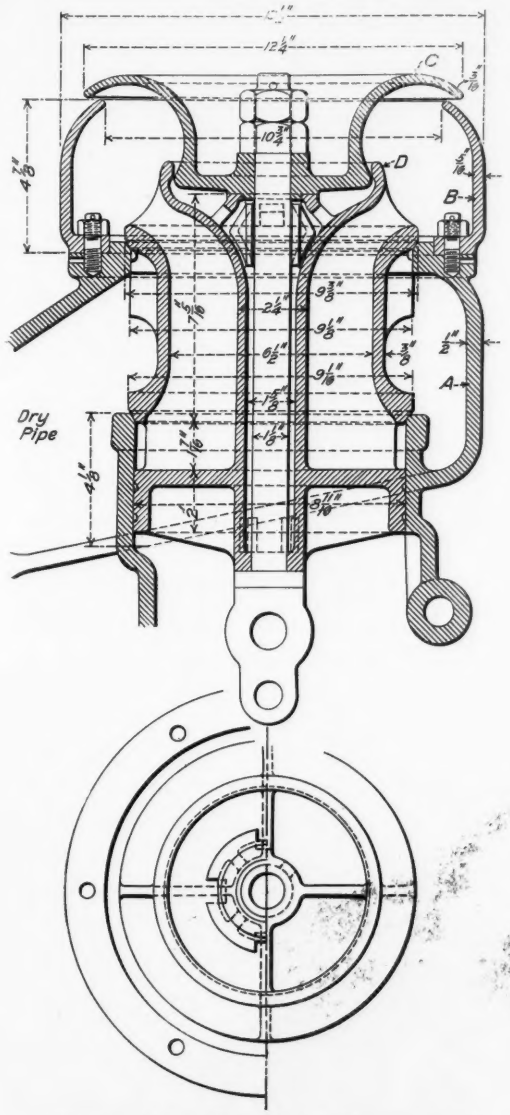
Steam from the high-pressure cylinder passes into a 9-in. receiver pipe extending forward from the center of the cylinder saddle to which it is connected by means of a ball joint. In order to facilitate putting in place or removing, this pipe is made up of three sections and is connected at the front end by means of a slip joint to cover variations in length due to curving to a Y pipe through which steam reaches each of the low-pressure steam chests. The receiver pipe is laid out for 16-deg. curves. The flexible connections are the same as those used in the Baltimore & Ohio design, which have proved so satisfactory—no trouble from leaky joints having been experienced throughout the entire two years this engine has been in service. Steam from the low-pressure cylinders, which are located considerably ahead of the front end of the boiler, exhausts back through a flexible pipe connection to the exhaust pipe in the smokebox. The high-pressure cylinders are equipped with piston valves, and the low-pressure cylinders with Richardson slide valves. The valve gear is, of course, of the Walschaert type. By an ingenious arrangement of the reversing gear the weights of the valve motion of the front and rear engines counterbalance each



Front View of Erie Mallet Compound Rounding a Curve.

other. The side elevation clearly shows the arrangement. As the high-pressure valves have an internal admission and the low-pressure an external admission it was possible with this arrangement of reversing gear to obtain a most satisfactory valve motion with both eccentric cranks leading the pin, the rear engines taking the forward motion from the top of the link and the front engines from the bottom of the link. The operation of the engine is rendered easier than that of an ordinary road engine by the application of pneumatic reversing cylinders to the ordinary gear with positive automatic locking in any desired position. The frames of both the front and rear engines are of cast steel, 5 in. wide. The articulated connection between the front and rear frames is shown in the illustration of the side elevation.

The part of the weight of the boiler which is carried on the forward engines is supported by a self-adjusting sliding bearing



Throttle Valve; Erie Mallet Compound.

located between the third and fourth driving-wheels. This bearing consists briefly of a built-up saddle casting which extends down and bears on a cast steel cross-tie directly below it, through a wrought iron case hardened sliding plate. A brass wearing plate is introduced between the boiler bearing casting and the wrought iron plate. The sliding plate is radially planed on the bottom so that it adjusts itself to the alinement of the engine and the load on the sliding plate is at all times perfectly distributed and there is no cutting of the wearing surfaces. Movement in a vertical direction is prevented by a safety connection between the boiler bearing casting and the cross-tie, which prevents the frames from dropping away from the boiler in case of any derailment. There is also a similar safety connection provided at the front end of the boiler between the guide yoke casting and the exhaust pipe elbow.

Another sliding support is located between the second and third pair of driving wheels. This support is so adjusted that it does not take any of the load except under unusual conditions when inequalities in the roadbed make it necessary. It is provided with a floating balance device which serves to take some of the load off the main boiler bearing. This device consists of a pair of columns, one on either side of the center of the engine free to sway as the engine turns through curves. These columns have a ball joint connection at the upper ends with saddle castings bolted to the boiler and a ball joint connection at the lower ends with flap castings hinged to the bottom of a cross tie across the lower rails of the frame. Around the outer ends of these hinged castings are U-bolts, the horns of which extend up through the bottom of the cross tie and through coil springs seated on the cross tie. These springs thus exert an upward force on the columns equal to the total compression of the springs. The initial total compression is 30,000 lbs., which can be increased by screwing down the spring caps by means of nuts on the ends of the U-bolts. This boiler support is also provided with a spring centering device of the same design as that used on the Baltimore & Ohio engine.

Another sliding support is formed between the exhaust pipe elbow and the guide yoke casting. As mentioned above this support also forms a connection between the boiler and the frames.

The four pairs of front driving wheels are equalized together on each side and cross equalized in front of the forward drivers, making this system equivalent to a single supporting point. The rear engine on the other hand is equalized throughout on each side only without cross equalization. This forms a complete three point suspended engine, or the best obtainable condition for flexibility and ease on the track.

The following are some of the principal dimensions of the engine:

Cylinder diameter, H. P.	25 in.
Cylinder diameter, L. P.	39 "
Piston stroke	28 "
Wheel base, rigid	14 ft. 3 in.
" " total	39 " 2 "
" " engine and tender	70 " 5½
Weight	410,000 lbs.
Heating surface, tubes	4,971.5 sq. ft.
" " firebox	342.2 "
" " total	5,313.7 "
Grate area	100.0 "
Journals, main	10 in. x 13 in.
" trailing	9 " x 13 "
" tender	5½ " x 10 "
Steam pressure	215 lbs.
Firebox, type	Wootten
" length	10 ft. 6½ in.
" width	9 " 6¼ "
" thickness, tube sheet	½-in.
" thickness side, back and crown sheets	⅜-in.
" water space	5 in.
Tubes, number	404
" diameter	2¼ in.
" length	21 ft. 0 in.
" gage	0.125-in.
Smokestack, diameter	18 in.
Smokestack, above rails	15 ft. 5¾ in.
Valves, H. P. type	Piston
" L. P. type	Richardson balanced
" travel	5½ in.
" lap, H. P.	1⅛ "
" lap, L. P.	1 "
" exhaust clearance	¼-in.
" lead H. and L. P.	3/16 in.
Wheels, diameter, drivers	51 in.
Wheels, diameter tender	33 "
Tractive effort	94,800 lbs.
Ratio, high to low pressure cylinders	1 to 2.43

$$\frac{\text{Weight on drivers}}{\text{Tractive effort}} = 4.32$$

$$\frac{\text{Tractive effort}}{\text{Tractive effort x diameter of drivers}} = 909.87$$

$$\frac{\text{Heating surface}}{\text{Heating surface}} = 53.14$$

$$\frac{\text{Grate area}}{\text{Firebox heating surface}} = 6.46^*$$

$$\frac{\text{Total heating surface}}{\text{Weight on drivers}} = 17.84$$

$$\frac{\text{Heating surface}}{\text{Volume 2 H. P. cylinders} = 15.86 \text{ cu. ft.}} = 33.5$$

$$\frac{\text{Heating surface}}{\text{Volume 2 h. p. cylinders}} = 6.31$$

Tube heating surface, equated to firebox heating surface (Vaughan formula)	1,085.5 sq. ft.
Total equated firebox heating surface	1,428.7 "

*In per cent.

Picked Up on the Road.

BY GULF.

I am not what is ordinarily known as a traveling man, though I do move about somewhat, and I am not disposed to draw final conclusions from the experience of one man; still I cannot help wondering whether my experience is exceptional or whether I am a railroad hoodoo. During the past eight or nine months I have moved across a considerable territory in the south, east and north, on many different roads, and I have not yet reached my destination on time. This is a broad statement, but it is rigidly true. The

trains have been from 15 minutes to six hours late, and in not a single instance was it due to accident or track obstruction, but to carelessness and inefficiency in getting started or the inability of the locomotive to haul the train on schedule time. Yet when I speak to a railroad man on the subject he invariably claims that a late train is the exception. My experience tells me that that is not the truth, and I would like very much to see a show-down of the despatcher's sheets. I remember once, a number of years ago, I had such a controversy with a superintendent of one of the roads running out of New York, and he claimed that his trains were always on time. So I kept a record of about 275 trains on that road during the next nine months, and found only one that fell within the five-minute limit, and that was two minutes late. When I called the superintendent's attention to the subject I received no reply.

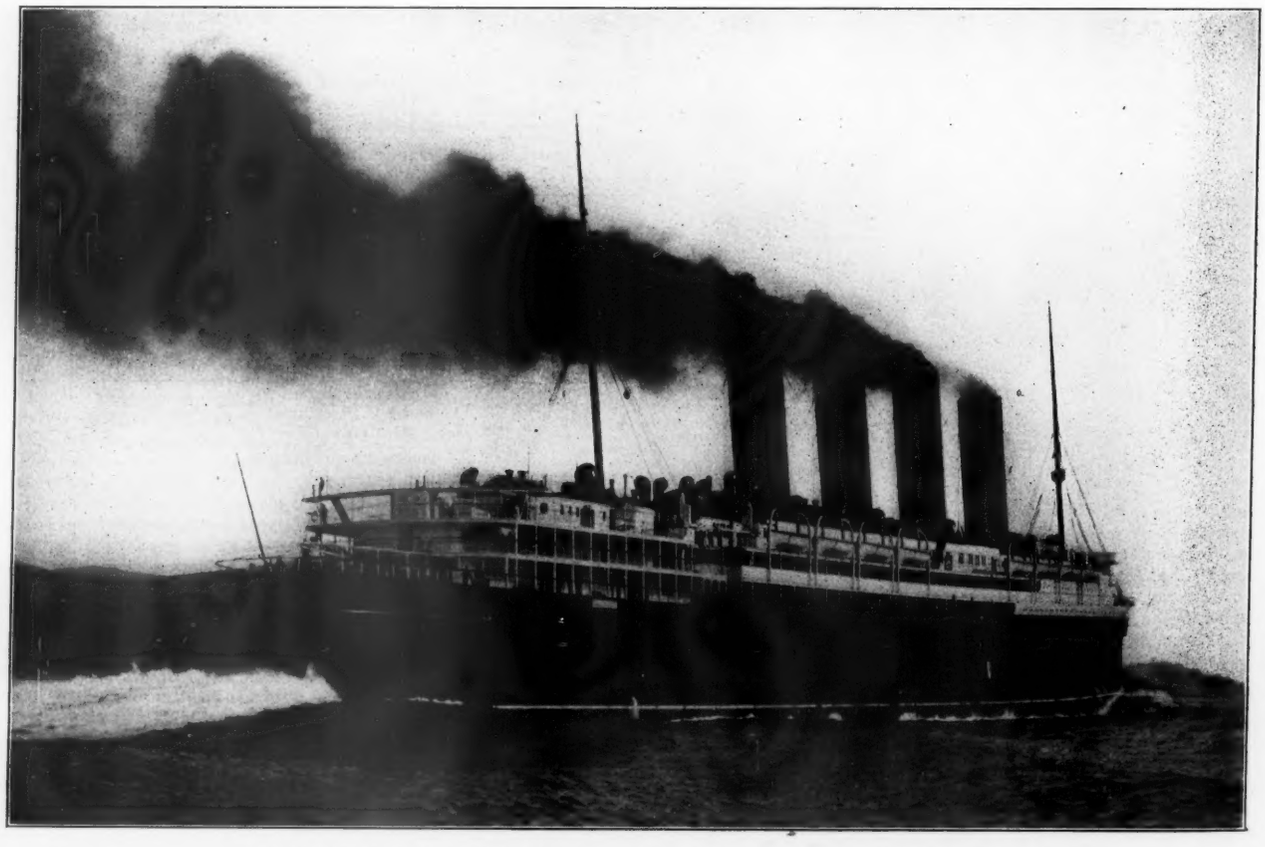
As a matter of fact there is no reasonable excuse that can be offered for a train regularly off schedule. Oh, yes; I know all about bad coal, head winds, slippery rail, loading baggage, and the other causes that are given as excuses *ad nauseam*, but they are not excuses. These causes of delay will occur and should be provided for in the schedule. It looks very nice to make up a schedule on a 50-mile pace for an express or a 30 for a local, but what is a paper schedule good for if the locomotive cannot do the work? The general manager and superintendent work it out that a certain type of engine ought to haul a given train between terminals in a definite time. The superintendent of motive power is coerced into saying "yes, under favorable conditions." So the schedule goes into force on the assumption that the conditions will always be favorable on our line, and the train may make one or two trips on time. Then an extra car is added, or there is a little more slate than usual in the coal, or a theatrical company with a lot of baggage sees fit to go that way, and then the capacity of the hauling power is exceeded and "train late" is the result. "Train late" then becomes the rule, but the beautiful fast schedule remains on paper, a mockery to the trustful traveler who innocently confides in its untruthfulness.

It seems that the definition of the time-table should be changed from "a statement of the time at which trains are expected to arrive and depart from the several stations," to "a statement of the time at which some people hope they will."

Now, what is the result of this state of affairs? In the first place there is a feeling of unmitigated disgust aroused in the mind of the traveler. He feels that he has been imposed upon; that the railroad company has been derelict in the execution of its part of the contract; and there comes a determination to get even at the first opportunity. There is not one man in a thousand who would not prefer, by far, to travel on a very slow schedule and be sure of reaching destination on time than to take these fancy fast trains that lose time every inch of the way. This is not the expression of an individual opinion, but is the consensus of statements made to me by hundreds of men with whom I have talked on the subject. At present it is well-nigh impossible to schedule a trip with any certainty that the itinerary can be followed because of that *bete noir* of all travelers, the late train. So, if I have any advice to give to managers on the subject, it is, "Do not bite off more than you can chew; don't make a paper schedule that your wheels can only follow on rare occasions, if you wish to secure the favor of your patrons."

The effect of a late train on the employees is demoralizing, to say the least. Ask any yardmaster what it means to him to have a train late. His movements are all disturbed and the orderly execution of his work made an impossibility. His crews will try to steal a few more seconds on the main line or be late in breaking up the train, and so more time is lost and a bad matter becomes worse, and when this is scattered throughout the line, the despatchers become overworked, crews and agents become confused by the multiplicity of orders, and the climax is reached by somebody forgetting. Then there are damages galore, that ought to put a damper on the complacency of the general manager. But instead of that he puts the blame on the poor devil who forgot, instead of realizing that the fast schedule that the engine could not make was the primary cause of the trouble, and that "Thou art the man" should be sent home to him.

I know of the troubles with labor and the difficulty of securing reliable men, and so does every superintendent in the land. And knowing this, the blame comes home so much the more, in that there is put upon this unreliable material a task that it is impossible for it to perform. If state legislatures and railroad commissioners and general executive reformers would pay less attention to rates and rebates and see to it that the railroads do not make time-table bargains that they cannot execute, and when an accident occurs to a belated train, besides hauling up the forgetful one, would go deeper and see what may have been the record of that train in the past as to punctuality, and what is the common practice of the road, they would get closer to the true cause of the difficulty than they usually do. Then, if they must act or legislate, let it be along the lines of cutting down impossible schedules and seeing to it that those made are lived up to, and thus earn the commendation of all concerned—the traveler and the employee—with the possible exception of the manager who is so smugly complacent over the 50-mile schedule for a 40-mile gait, and whose complacency may well be ruptured for the general good of the public.



The Lusitania, of the Cunard Line, on Her Trial Trip. (See Editorial Page).

Electrification of the New York, New Haven & Hartford.

BY E. H. MC HENRY,
Vice-President, N. Y., N. H. & H.

The New Haven company was one of the pioneers in the field of heavy electric traction, and has operated six of its shorter branch lines by electricity for a number of years past, beginning as early as 1895. Three of these lines, aggregating 33 miles, were equipped for overhead contact, and the remaining lines, aggregating 39½ miles, for third rail operation. All lines were operated with 500 volt continuous current, supplied from main stations and substations. The third rail was primitive in form and without protective devices of any sort. So many accidents followed the use of this method of supplying current to the motors that the railroad was compelled to abandon all third rail operation in Connecticut, and revert to steam service, by a decree of the Superior Court dated June 13, 1906, and it now has no third rail in service except a junction overlap with the New York Central at Woodlawn. The unsatisfactory experience with this type of construction influenced the company's decision in favor of the single phase system for the New York terminal electrification, which was finally adopted after a careful investigation of the relative merits and disadvantages of the two methods of construction.

Had the study of the question been limited to the equipment of the terminal section in New York, considerations of uniformity and expediency would doubtless have influenced the decision in favor of continuous current motors, taking current from a third rail. The New Haven, however, recognized the importance of its decision in its effect on future extensions of electric service to other parts of its system, and the final decision was based upon a study of the subject as a whole rather than upon the solution of the terminal problem only. The selection of a system of transmission which combines efficiency, flexibility, simplicity and lowest first cost, was important. The New Haven system comprises a network of lines and its transmission problems must be worked out for areas rather than for linear distances, thus reversing ordinary conditions. As the area served increases as the *square* of the radius of transmission from the generating center, the commercial and practical value of high potential transmission is much increased.

While both methods under consideration included high tension transmission by alternating current, it was believed that the combination method requiring transforming devices and continuous current motors was less well adapted to the conditions than single phase for many reasons. The electric efficiency of the combination system between power house bus bars and engine shoes is 75 per cent. only, as compared with 95 per cent. for the single phase system. The flexibility of the combination system is impaired by the limited radius of the secondary low tension distribution, requiring substations at frequent intervals, and still further by the limitations imposed by the use of a third rail. The position and height of this rail must be rigidly maintained, and the practical margin of permissible variation is small. Its continuity is broken at switches and crossings by frequent transferrence of the conductor rail to the opposite side of the track or to an overhead position. In contrast, the single phase system requires no substations or secondary circuits; the continuity of the overhead conductor is complete, and its position and height may vary within vertical and horizontal limits of 8 ft. and 4 ft., respectively, without losing contact with the collecting shoes on the pantagraph frames.

It is yet too early to furnish definite and positive comparisons of cost of the two methods under consideration, but the calculations and experience of the company's engineers indicate that the total cost of a single phase installation will be much less than that of the continuous current system, and that the higher electrical efficiency, lower fixed charges, maintenance and operating expenses of the single phase system all tend to reduce the relative cost of current delivered to the engine shoes in about the same proportion.

The determination of the most economical and desirable frequency and voltage of the transmission system involved the consideration of many factors. The choice of frequency was limited to 15 cycles or 25 cycles. The lower frequency afforded a material reduction in weight, size and cost of motors, a reduction in conductor losses and induction disturbances, together with an increase in the power factor of the motors, but its adoption would have materially impaired the commercial value of the system as a whole, in restricting or preventing its extension for many other uses incidental to railroad operation. The standard frequency in general use is 25 cycles, and as the New Haven already owned a number of power houses generating current at this frequency for trolley operation, and, in addition, had equipped many of its shops with 25-cycle motors, the adoption of 15 cycles would have required the abandonment of a large amount of standard apparatus, or the interposition of costly and inefficient means of translation. It was also considered desirable to provide for operation in parallel with the 25-cycle generators already adopted by the New York Central. The practical effect of a change from 25 to 15-cycle apparatus was thus substantially equivalent to a "break in gage," and it was decided that the practical commercial value of the higher frequency outweighed the theoretical merits of the lower one.

Various alternatives were considered before fixing the generating and transmission *e. m. f.* of the system. It was at first proposed to increase the economical radius of transmission to the utmost by generating current at the highest initial voltage for which generators could be safely designed (about 22,000 volts) and to provide substations at suitable intervals, equipped with static transformers, for supplying current at 3,000-6,000 volts to secondary contact circuits. As the two motors in each electric locomotive truck are permanently connected in series, current must be supplied at 560 volts through the transformer which forms part of the locomotive's equipment. It became evident, however, that a great gain in simplicity would result if the intermediate substations and line transformers could be cut out altogether by reducing the initial *e. m. f.* to 11,000 volts and raising the ratio of the locomotive transformer to correspond. This was done with a resulting reduction in capital and operating cost, coupled with an increase of electrical efficiency. Incidentally, the difficulties in designing satisfactory collecting devices were greatly diminished.

Before giving a detail description of the apparatus used in the electrified district it may be interesting to give a few comments on the commercial aspects of electric traction, as the natural prejudice of the stockholder in favor of the continued maintenance of dividends must be respected, and the technical expert too frequently neglects this in his scientific ardor.

Numerous analyses and comparisons of the comparative costs of electric and steam operation have been published from time to time, which tend to prove that a considerable saving in fuel, engine repairs and other operating expenses may be expected. Under favorable conditions this saving may be large enough to pay interest and other fixed charges on the additional construction investment and still leave a satisfactory margin to be applied to dividends. Under general conditions, however, it is altogether improbable that the direct saving resulting from the simple substitution of electric for steam power will be sufficient to justify the additional investment and financial risk.

In changing the method of motive power on existing railroads, the conditions are by no means so simple as in the construction of new lines, since a great amount of capital already invested must be sacrificed, and the problems of adaptation to existing conditions are peculiarly severe. The transition stage in bridging over the gap between steam and electric operation is both expensive and difficult, as the change affects train lighting and heating, telegraph and telephone service, signaling and track maintenance, for which both temporary and permanent provision must be made. The simultaneous maintenance of facilities and working forces for both steam and electric service within the same limits will rarely be profitable, for the reason that a large proportion of expenses incident to both kinds of service is retained, without realizing the full economy of either.

To secure the fullest economy it is necessary to at least extend the new service over the whole length of the existing engine district, and to include both passenger and freight trains.

The application of electric traction to heavy railroad service will probably be governed by other and more important considerations than its mere relative cost as a motive power under similar conditions, as illustrated in the development of the ordinary trolley service. In this development the commercial value of higher speeds and of increased car capacity is so large that the relative cost of electric versus animal tractive power becomes almost negligible by comparison. Analogous results may be hoped for in the corresponding development of electric traction in heavy railroad service, as the new conditions will afford opportunities for at least two radical modifications of existing conditions, quite apart from minor economies.

In steam service the weight and speed of trains are limited by the horse-power capacity of the locomotive, which generates its own power, and there are but few locomotives which can generate sufficient steam to utilize their full cylinder tractive power at speeds in excess of 12 miles an hour. Consequently, any increase of speed beyond certain limits can only be attained by sacrificing train tonnage in a corresponding degree. The division of the train-mile cost by the lesser number of tons increases the ton-mile cost proportionately.

The high cost of fast freight service is principally due to this effect of a diminishing divisor, while it would seem that electric traction should permit high speeds without sacrificing commercial tonnage, as, with a relatively unlimited source of power at command, the maximum drawbar pull permitted by the motor design, may be maintained at all speeds.

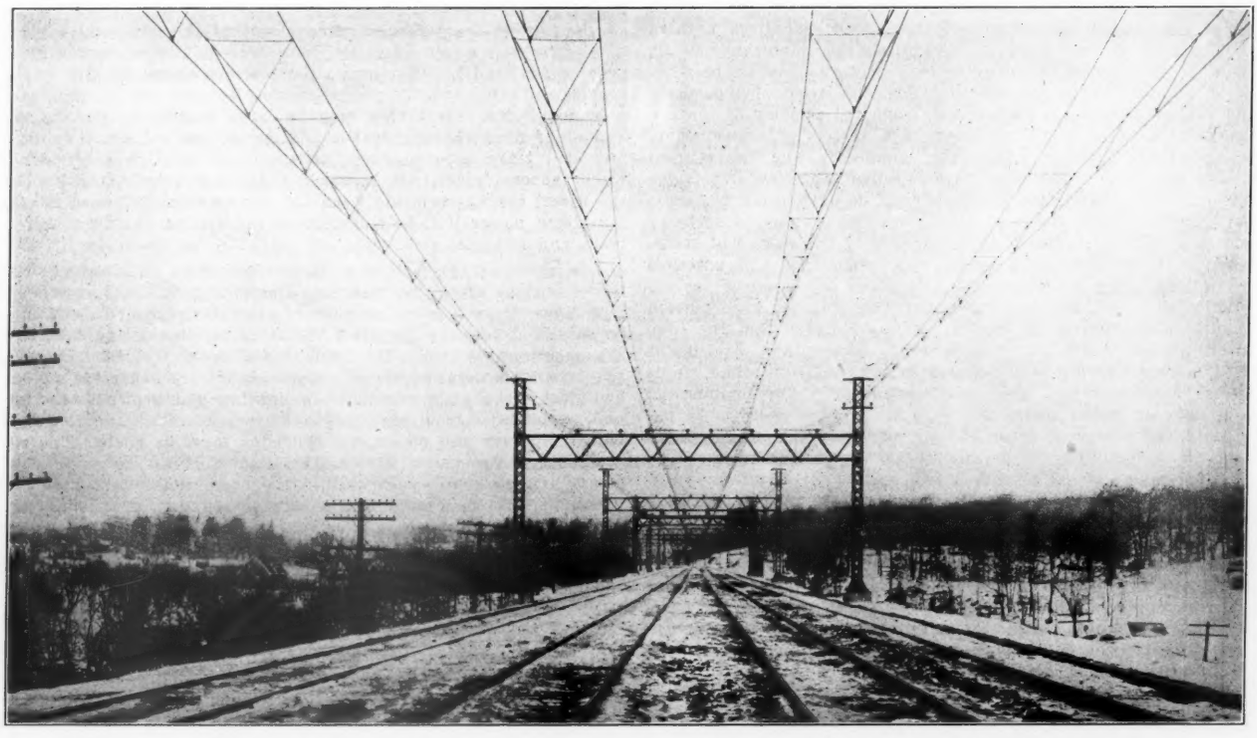
Hardly less important is the opportunity afforded for the economical operation of trains of *minimum* capacity. The train capacity cannot be reduced, without loss, below the point where the earnings equal the train-mile cost, and if this cost cannot be reduced proportionately with reduced capacity, the inferior limit of capacity may be uneconomically large. In steam service the irre-

ducible elements entering into the train-mile cost are so large that it is rarely profitable to operate trains earning less than 40 to 50 cents per mile. In contrast, electric service permits an extreme reduction of the train length to single car units, costing to operate but 10 to 15 cents per car-mile. Hence, the frequency of service may be increased and rates reduced, which in turn will react on the volume of traffic, with the final result of increasing both gross and net earnings. It may, therefore, be claimed for electric traction that it will extend the limits of profitable operation of high-speed heavy trains, and also of light trains of low capacity.

Other but relatively minor advantages are possible in the effect on earnings, due to the elimination of smoke, gases, dust, cinders and heat, the better ventilation of cars, the extension of electric train lighting and heating; and of the effect on expenses due to the concentration of power production in large and economical power houses, a reduction of engine repairs, an increase of effective engine and train mileage, a more or less complete elimination of engine houses, turntables, fuel stations, water tanks, cinder pits and other operating facilities, the consolidation of power requirements for traction, pumping, operating shops, elevators and general uses, and the use of current for lighting switch lamps, stations and other buildings.

Finally, the availability and value of real estate and structures at large terminals will be greatly augmented by the possibilities of using two or more superimposed track levels, as in the new terminals in New York for the New York Central and the Pennsylvania.

A general change from steam to electricity will render unproductive a very large amount of invested capital, and create the necessity for the expenditure of additional amounts still greater, but there is no reason to doubt that the transition already in progress will be rapidly extended and applied at all points where congested terminals, high frequency of train service and low cost of power create favorable conditions.



Overhead Catenary Construction over Four Tracks; New York, New Haven & Hartford.

OVERHEAD LINE CONSTRUCTION.

The overhead line construction is of the catenary type and consists of two steel cables of high strength, supported at intervals by steel bridge structures. A copper conductor or trolley wire is suspended below the two supporting cables by means of hangers placed at frequent intervals. Wherever the cables pass over the steel supporting bridges they rest on porcelain insulators, and at intervals heavy bridges are provided against which the cables are anchored by means of specially constructed strain insulators.

The steel supporting bridges are of varying lengths so as to accommodate four, five, six or as many as 12 tracks, as the local conditions require, without placing posts between tracks. These bridges are of a uniform design and consist of angle iron and lattice bar construction. The anchor bridges are provided with automatic circuit-breakers by means of which the different sections may be isolated, and also the several parallel tracks separated from one another in case of accident to any one track. The anchor bridges also carry lightning arresters, shunt transformers for operating the circuit-breakers, together with foot walks, hand railings, lighting circuits and the wires and conduit for the auxiliary control circuits.

The main conductors over the running tracks are paralleled throughout their entire length from Stamford to Woodlawn by two feeder wires. These feeders constitute auxiliaries to the main track conductors and are connected with the latter at each anchor bridge through circuit-breakers. The auxiliary feeders provide means for feeding around any one section in case it is cut out of service on account of some accident in that particular section.

In laying out the bridges for the section from Woodlawn to Stamford, it was found that the sharpest curvature was 3 deg. As this curvature will permit of stringing trolley wire in straight lines between points of support 150 ft. apart without deviating from the center of the track more than 8½ in. on each side, it was decided to place all bridges a fixed distance of 300 ft. apart, and on curves to provide guide poles from which pull-over wires are attached and secured to the catenary spans. By this means a minimum amount of overhead wiring was obtained, and the deviation from the center of the track was maintained within safe limits.

The standard four-track intermediate bridge consists of two supporting side posts and a horizontal truss. Each supporting post is approximately 38 ft. long by 1 ft. 10 in. square. Each is composed of four 4-in. x 4-in. x $^{7}/_{16}$-in. angles, secured together by 2¼-in. x ⅜-in. lacing bars. Each post rests on a concrete foundation. The cross truss is bolted to the vertical posts, allowing a distance of 23 ft. 4 in. from the lower side of the truss to the top of the rails. The truss is 4 ft. 6 in. deep from back to back of the upper and lower chord angles, which are placed 1 ft. 10 in. from back to back. The upper chord angles are 3½ in. x 6 in. x ⅜ in. and the lower are 4 in. x 3½ in. x $^{5}/_{16}$ in.

The extensions of the side posts above the trusses are utilized for supporting the feeder wires which are carried on angle iron cross arms bolted to the posts. The lower cross arm carries the auxiliary feeder. The upper cross arm is located 5 ft. above the lower one and carries two wires of three-phase circuit. The third wire of the three-phase circuit is carried on a light vertical channel iron support which is not shown in the illustration.

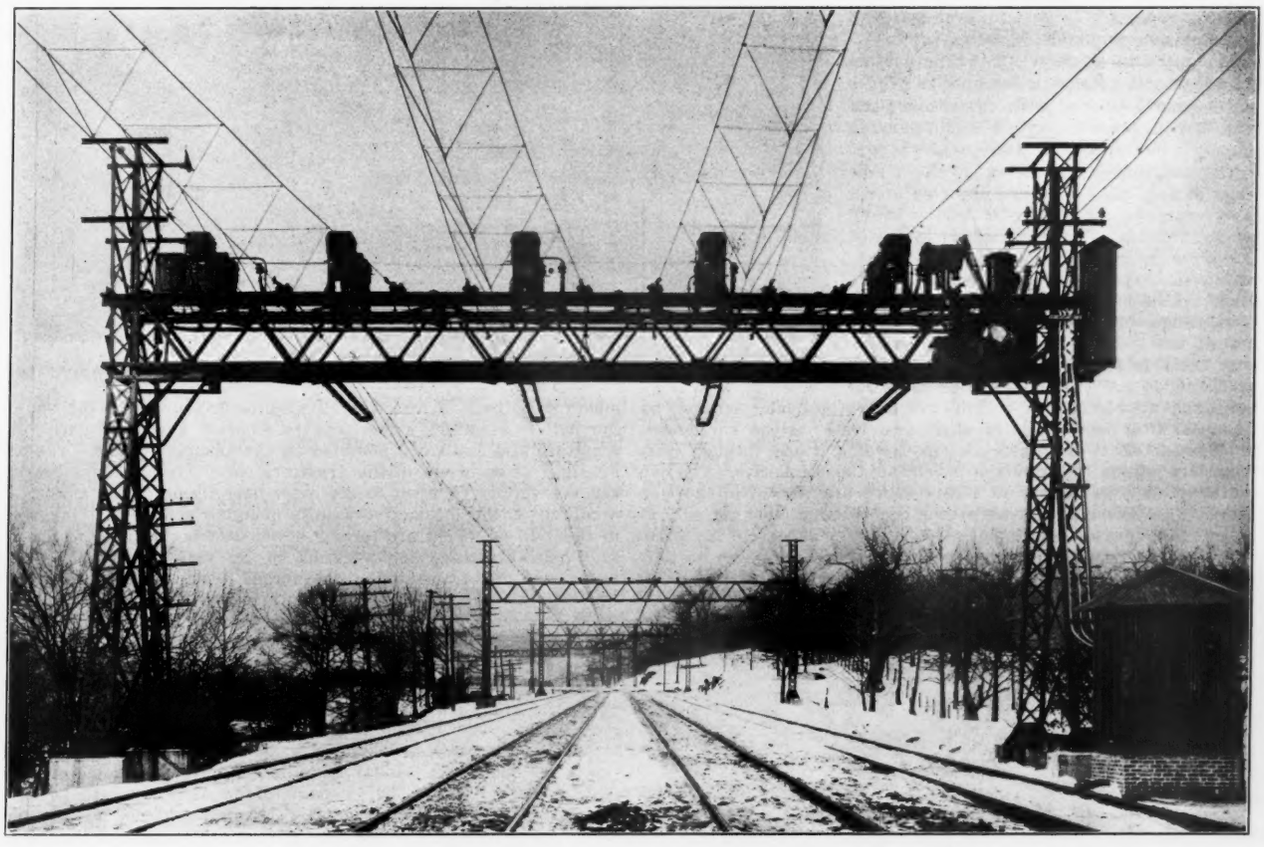
Anchor bridges of heavy construction are placed every two miles, and against these bridges the catenary cables are anchored. The auxiliary apparatus and signals are mounted on the bridge, the semaphore blades being located below the truss so as to afford an unobstructed view to the engineer. The four-track anchor bridge consists of two A-shaped posts having a spread at the base of 15 ft. and a width at right angles to the track of about 2 ft. The main members of the posts consist of 6-in. x 4-in. x ⅝-in. angles. These posts are also extended above the truss for carrying the feeder

wires. The truss is bolted to the side posts, allowing a clearance above the rails to the lower side of the truss of 24 ft. 3 in., and is 4 ft. 6 in. deep by 5 ft. wide between the backs of the chord angles. The upper chords consist of 8-in. x 8-in. x $^9/_{16}$-in. angles, and the lower chords consist of 4-in. x 3½-in. x $^9/_{16}$-in. angles.

A ladder is provided on one of the posts leading to a small platform at the end of the truss. This platform is provided with a hand rail and carries upon it a box containing an 11,000-volt, low-equivalent lightning arrester. A portal is provided in the end of the truss by means of which the attendant may step to the platform supported upon the lower chord of the truss. From this platform access is provided to the short ladders leading to the signal lanterns and a second short ladder extending up to another platform supported upon the upper chord of the truss. This platform is surrounded by a hand rail which is also attached to the iron supporting frames of the circuit-breakers in such a manner that the attendant can in no way come in contact with the live parts of the circuit. At each end of the truss a 5-k.w., 11,000-volt, shunt transformer is provided, one of these being connected directly into a bus-bar which runs around the outside of the circuit-breakers and which is supported on porcelain insulators and bus-bar brackets are right-hand, it is impossible for the hanger to come loose.

At each anchor bridge it is necessary to provide an insulator and a trolley wire, and this is accomplished by means of two bronze end castings to which the ends of the trolley wire are bolted. Two parallel sections of impregnated hard-wood are fastened to these castings, and to these wooden strips are fastened renewable pieces of trolley wire in such a manner that the ends of these renewable pieces overlap one another. By this means the sliding contact on the locomotive passes from one section to the next without opening the circuit, thus avoiding all flashing.

At a number of points along the road overhead bridges reduce the clearance above the tracks, and at these points special construction is used. This construction consists of a long corrugated porcelain tube mounted on an iron pipe carried by means of pipe fittings from the lower side of the bridge. The messenger cables where they pass under the bridge are heavily insulated, and the hangers which support the trolley wire from the messenger cables are placed midway between the porcelain insulators so that the maximum amount of flexibility is obtained. The trolley wire hangers are of impregnated wood so that the trolley wire is completely insulated from the catenary cables. A waterproof shield is attached



Four-Track Anchor Bridge with Circuit Breakers and Section Breaks.

secured to the upper chords of the truss. The other transformer is connected directly to one of the "power" feeders. As the "power" feeder is connected to the third phase of the generating system, this provides means for operating the switches in case of accident to the trolley section. The four-track anchor bridge is secured to concrete foundations by long anchor bolts and nuts.

Each of the two catenary cables which support the copper trolley conductor consists of an extra high strength steel cable, $^9/_{16}$ in. in diameter, consisting of heavy strands. This steel has an ultimate strength of about 200,000 lbs. per square inch, and each strand is heavily galvanized. The completed cable has an ultimate strength of 33,800 lbs. These cables are strung between the bridges, with a sag at mean temperature of 6 ft. in a standard span of 300 ft.

The trolley wire, which is No. 0000 grooved copper, is supported every 10 ft. from the catenary cables by triangular trolley hangers of varying lengths. These hangers are so adjusted in length that the trolley wire is maintained in a horizontal position, 6 in. below the catenary cables at the middle point of the span. They consist of a pair of small drop forged steel jaws, which engage with the grooves of the trolley wire and are clamped by means of a malleable iron Y which is screwed down upon the threaded portions of the jaws. The sides of the triangle are then screwed into the Y and are bolted to the messenger cable above. As all of the threads to the bridge above the insulating structure to prevent accumulations of dirt and water on the insulators.

At a number of points where there are numerous side-tracks, it is necessary to provide extra long bridge supports. An illustration shows one of these long bridges, which is designed to cover 12 tracks. The catenary cable insulators are attached to the lower member of the truss. Both rails of all tracks are bonded with No. 0000 compressed terminal flexible bonds placed round the fish plates.

Wherever one track diverges from another a section insulator is inserted in the trolley wire. Insulators are inserted in the catenary cables supporting the diverging wire between parallel tracks.

The diverging trolley wire is connected to the main wire by a frog of standard design, and in order to prevent the contact shoes on the locomotive from catching, deflector wires are placed in the angles between the two trolley wires. These deflectors are carried by yokes screwed to the trolley wires and to yokes at the ends fastened to the catenary hangers. These deflectors are raised at each end so that the collector shoe cannot catch over them.

ELECTRIC LOCOMOTIVES.

The specifications under which the locomotives were built require that they shall be able to handle a 200-ton train on the most severe schedule in the present time-table, corresponding to the local express which stops about every 2.2 miles and operates on a schedule

speed of over 26 miles an hour. This requires a maximum speed of about 45 miles per hour. The locomotive is also to haul this weight of train at 65 to 70 miles per hour and a 250-ton train at 60 miles per hour in the long runs. Three 100-ton, or even heavier, trains may also be handled on the long runs at reduced speeds. Heavy trains may be operated at high speeds by coupling two or more of the locomotives together and operating them on the multiple-unit system.

The design of the locomotives was largely dictated by certain requirements: (a) Gearless motors having a flexible drive and with all the weight carried on springs were desired and finally adopted as the most desirable form, and (b) operation on 600 volts direct-current necessitated the use of four motors in order that they might be operated in the usual series-parallel relation.

The bogie truck type was adopted after careful consideration as the one best adapted to meet the conditions imposed. Its riding qualities are the best and it offers the least resistance in taking the curves in the line. The locomotives are 36 ft. 4 in. over bumpers and weigh approximately 90 tons.

The mechanical parts of the locomotive were built by the Baldwin Locomotive Works from designs developed with the co-operation of the Westinghouse Electric & Manufacturing Company and the New Haven engineers.

The longitudinal members of the frame consist of deep plate girders reinforced at the top by channels and at the bottom by heavy angles and plates. To these frames are riveted plate cross members, one over each truck, forming the transoms. These transoms are further braced by gusset plates riveted to the bottom flanges of both sets of channels, which transmit the tractive power from the center-pin to the side frames. The side girders are placed outside the wheels as low down as the wheels and drawhead will permit and are braced and squared by substantial steel flooring plates which are riveted to the top flanges. The drawbar effort is transmitted to the side frame through deep box girders joining the frames at the ends of the locomotive. The cab is built up on a framework of Z-bars which are riveted to the side girders. This forms a light but strong construction, able not only to transmit large drawbar pulls but to resist heavy shocks in bumping.

The running gear consists of two trucks, each mounted on four 62-in. driving wheels. The trucks have side frames of cast steel to which are bolted and riveted pressed steel bolsters which carry the center plates. A strong construction is secured without excessive weight by the use of bolsters 30 in. wide at the center plate and extended to nearly double that width at the ends where they are bolted to the side frames. Center bearings 18 in. in diameter transmit the tractive effort to the frame. They are well lubricated to permit free motion on curves. The weight on the journal boxes is carried by semi-elliptic springs. Under the ends of the equalizer bars are small spiral springs to assist in restoring equilibrium. The distance between truck centers is 14 ft. 6 in.

The motors are of the gearless type. The hollow shaft of the armature is made in two halves. These two halves are alike and each is provided with an end disk from which project seven hollow pins. Each half is forced by hydraulic pressure into the ends of the hollow armature spider and is securely keyed in place. The armature and quills are mounted on the locomotive axle. The split housings at each end of the armature carry the armature bearings and are rigidly clamped to the outer field frame of the motor. On each end of the locomotive axle is mounted a 62-in. driving wheel in the hub of which are formed seven circular pockets which contain helical springs for assisting in carrying the weight of the motor and for transmitting the torque from the armature. Into each of these pockets there projects one of the hollow pins on the end of the armature shaft. Each pin is surrounded by a spring placed between the outer circumference of the pin and the inner circumference of the pocket. This spring is arranged so as to tend to hold the pin concentric with the pocket, and it resists yieldingly to any gravitational or torsional force for a total movement of ¾ in. The spring is of unusual form; its turns are progressively eccentric. Thus an end view of the spring would show an inner radius and an outer radius differing from each other by ⅜ in. greater than the thickness of the stock from which the spring is built. Between the outer circumference of the spring and the inner circumference of the pocket is fitted a sheet iron tube, and a similar tube is placed between the spring and the pin. These tubes and the spring form a unit which may be taken intact from the pocket when the outer end cap is removed. On account of their mechanical form and their position in the pockets these springs cannot be stretched beyond their elastic limit, and, since each pocket is provided with adequate lubrication it is expected that they will withstand the most severe wear and last indefinitely. They are capable of sustaining the whole weight of the motor, but they will normally be used solely for transmitting the torque to the drivers. Each pin contains a hollow space in which is placed an additional spring which serves for receiving the end thrust of the motor against the drivers.

The method of carrying the weight of the motor from the truck and of resisting the backward torque of the field structure is by providing a steel frame entirely distinct from the truck and pivoted from the journal boxes of each locomotive axle. From this frame

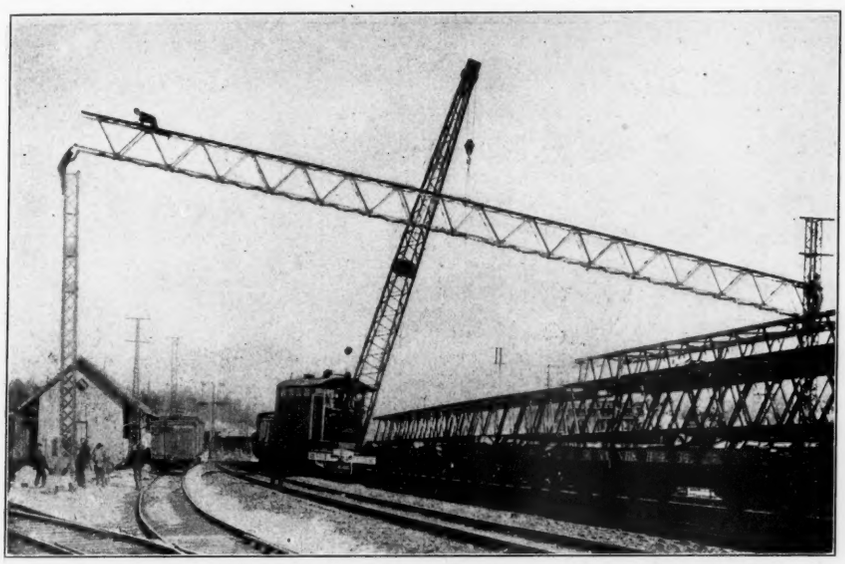
Deck of Anchor Bridge, Showing Circuit Breakers and Other Auxiliary Apparatus.

Method of Erecting Bridge Columns with Locomotive Crane.

the weight of the motor is carried by springs on which rest lugs of the field structure. The adjustment of the tension on these springs determines what portion of the weight of the motor is carried by them and just how much weight is carried through the pins on the armature quill. Since the frame from which the motor is suspended is distinct from the truck the swinging of the locomotive can have no effect on the motor, and the motor delivers a cushioned blow to the rails. The backward torque of the field is transmitted to the truck through rods which permit a certain amount of vertical motion in the motor. The armature and field windings are of the usual form employed in Westinghouse single-phase series motors. The armature winding is closed in itself and is indirectly connected to the commutator through preventive leads which reduce the short circuit current produced when the brushes pass from one commutator segment to the next. The field winding is of the compensated type with the compensating field evils wound in slots in the projecting pole pieces. These compensating coils are always in series with the armature circuit and serve to neutralize the reactance of the armature.

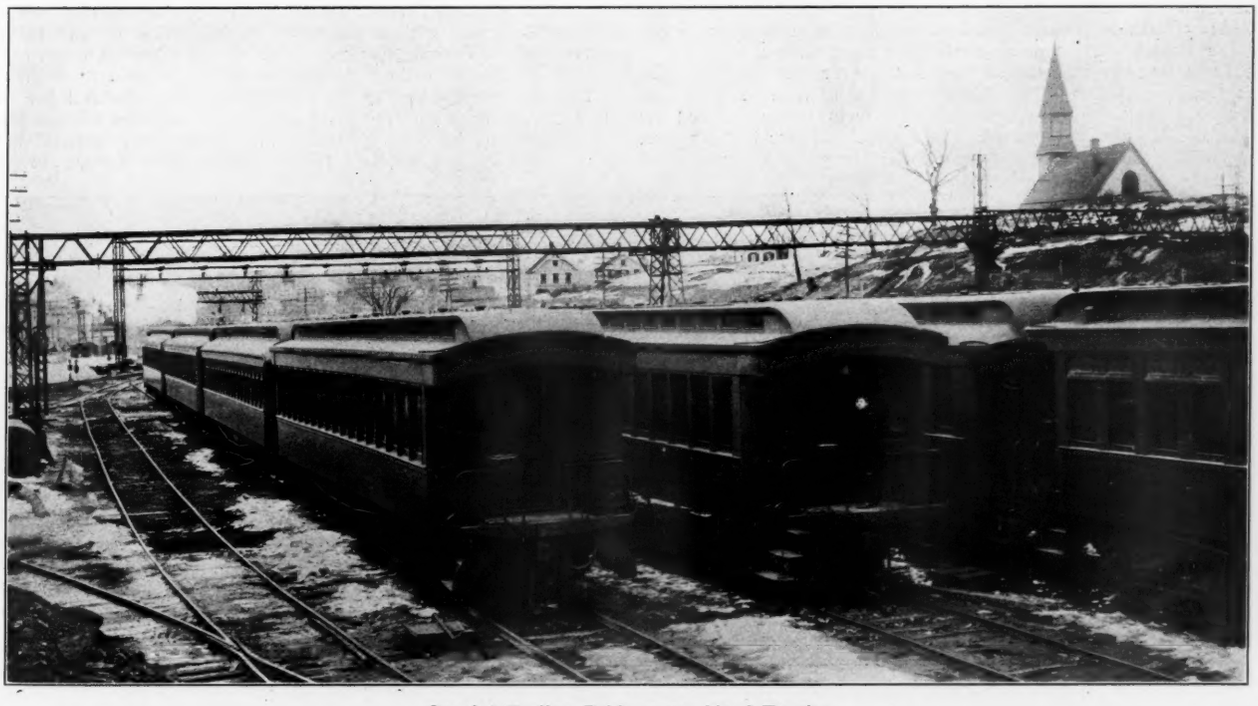
There are several brushes per holder and both the brushes and holders resemble closely those used for direct-current work. The brushes are ⅜ in. thick and are pressed against the commutator by a coiled spring. The total locomotive mileage is not yet sufficient to determine the life of the brushes except by approximation from the present rate of wear, and this has been so small that an accurate estimate cannot yet be made. A flexible copper jumper or shunt is used for carrying the current to the brush.

The two armatures on each truck with their corresponding compensating field coils are joined permanently in series and are operated at all times as a unit. For direct-current work the two-motor units of each locomotive are connected in series at starting and in parallel at full speed, while for alternating-current work the two units are joined in parallel at all times. Although during direct-current operation the familiar series-parellel method of control is employed, several unusual features have been introduced so that the losses during acceleration are equally as small as would be the case if there were complete series-paralleling of the four motors by the method used ordinarily with four-motor equipment. The motors being of the compensated type will run sparklessly with the fields weakened to any desired extent, and this condition is taken advantage of during the acceleration period before passing from the series to the parallel position. Thus there is eliminated a large portion of the loss which would take place in the resistance if the motors were changed directly from the normal series position without resistance to the parallel position with the full resistance in circuit. Much of the lower part of the normal speed range in the parallel position is covered by the motors connected in series with shunted field coils.



Erecting a Long Trolley Bridge Truss in the Yards.

The acceleration is extremely smooth, which is to be attributed partly to the facts just stated and partly to the fact that in passing from the series to the parallel connection the circuit to neither motor is opened nor is either motor short-circuited. In the initial series position at starting, one motor unit is connected to the ground side and the other to the trolley side, with the resistance in series between them. In the final series position the resistance is out of circuit and two units are in series across the line. If now there be connected in parallel with each motor unit a resistance of a value such that one-half of the line voltage will cause to flow through it a current equal in value to that passing through each motor, the two motor units will in effect be connected in parallel across the line, each unit having in series with it a resistance which absorbs one-half of the line voltage. Under this condition no current will flow directly through the middle-voltage connection between the two motor units, and this connection may be broken without changing the performance of the motors, after which the resistance in series with each motor may be decreased until the two units are directly in parallel across the line.



Special Trolley Bridge over Yard Tracks.

During alternating-current operation each motor unit is fed at variable voltage from the secondary of a step-down transformer, there being two separate transformers on each locomotive. The same master controllers are used for alternating-current as for direct-current.

Each switch used in the motor circuits is of the Westinghouse "unit" type, operated by air under 80 lbs. pressure and controlled by an electromagnet which receives current from a 20-volt storage battery. There are, therefore, on the locomotive three systems of wiring: the 11,000-volt primary circuits to the step-down transformers; the lower-voltage motor circuits (corresponding to the secondary circuits from the transformers and the equivalent 600-volt direct-current circuits), and the battery electromagnet circuits. The high-potential circuits pass directly from the trolleys through the manually-operated oil switch to one terminal of the primary of each of the step-down transformers, the other terminals of which are grounded to the locomotive frame. The lead from the trolleys to the oil switch is protected by a grounded covering, and only the 20-volt battery runs to the master controller. The motor circuits pass either from direct-current trolley, third-rail shoe or the taps on the secondaries of the transformers to the unit switches and through the motors to the ground.

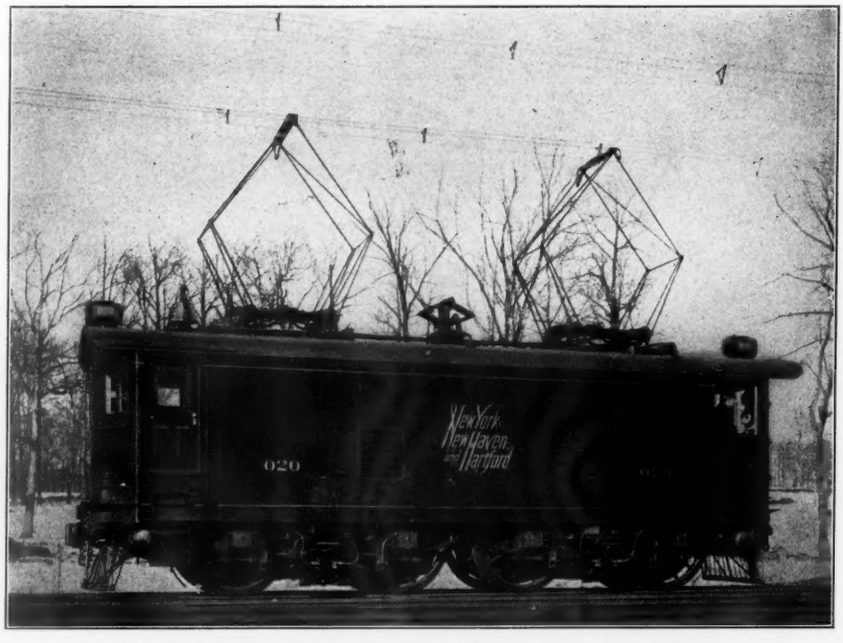
The unit switches are arranged in groups for convenience, and the switches of each group have their magnetic blow-out coils placed mechanically in the same line so that they assist one another in producing the blow-out flux.

The locomotive may be controlled from either end by means of a master controller which is of the usual type except that its handle is somewhat different from those heretofore used. The handle resembles somewhat the throttle lever of a steam locomotive. No gears are used, the handle being connected directly to the drum shaft. The reverse lever is mounted immediately below the operating lever of the controller. The circuits which run to one master controller are in multiple with those to the other controller. A continuation of these circuits through flexible leads from one locomotive to another allows any number of locomotives to be operated simultaneously from one master controller. When the master controller is in the off position, connections are so established that all circuit-breaker trips which may be open may be closed by pressing a small push button on top of the controller. Current is supplied to the control circuits by two sets of 10-cell storage batteries, each of which has a capacity of 40 ampere-hours and weighs 150 lbs. In connection with the switch groups, cut-out switches are provided so that either pair of motors may be cut out by simply rendering certain switches inoperative. It is thus possible to cut out the motors without manipulating the main circuit.

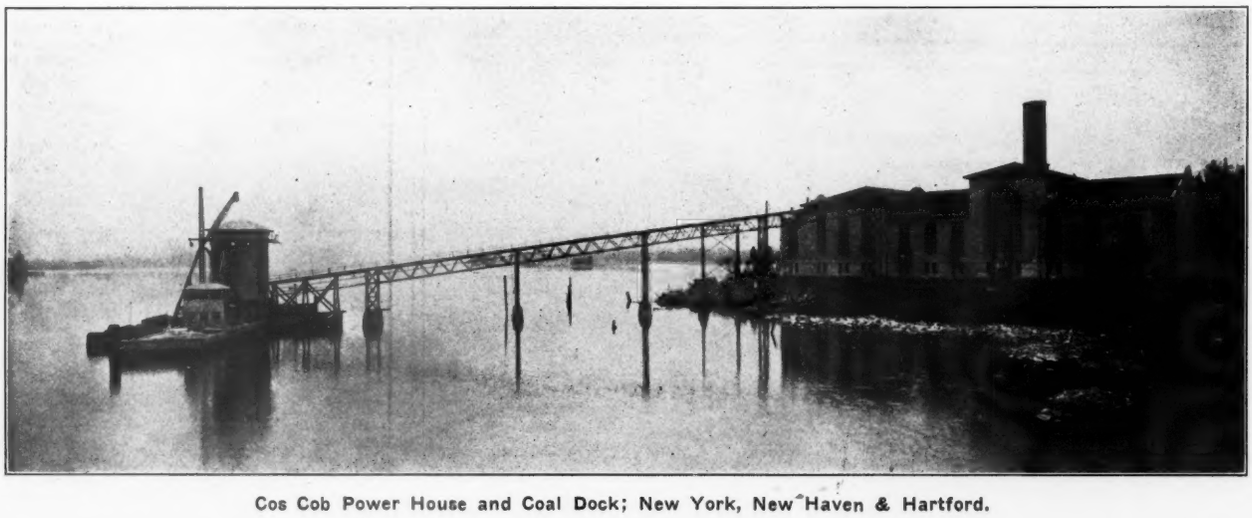
There are two pantagraph bow trolleys for collecting the current from the 11,000-volt overhead conductor system. The upward pressure against the wire is supplied by springs. Compressed air is admitted to a cylinder when it is desired to lower the collector. When the collector is in its lowest position a catch engages the mechanism and holds it in place. This can be released by means of an electro-pneumatically operated lever when compressed air is on hand, or it can be released manually if desired. The framework of the pantagraph mechanism is built up of steel tubing and the collector bow is a broad strip of soft copper. The collector mechanism is mounted on moulded insulators bolted to the roof of the locomotive.

For use over the New York Central tracks there have been provided both a second and lower overhead direct-current pantagraph trolley and third-rail contact shoes. The direct-current trolley is of the same general type as that used of the high-potential collectors and it is mounted over the center of the locomotive. There are two mechanically separate but electrically interconnected contact shoes on each side of each truck, making a total of eight shoes per locomotive. These shoes are designed for use with either an over-running or an under-running rail, and the mechanical pressure in each case is supplied by springs. On account of the fact that no third-rail will be used over the high potential portion of the route, and the projecting shoes in their normal position would be liable to strike any small obstruction along the side-paths, a device is used for lifting the contact shoes out of the way when the locomotive is using alternating-current. This device will be operated electro-pneumatically and will be automatic so that when the alternating-current circuit is completed the shoes will be lifted from the rails.

All of the controlling mechanism of the locomotive is placed in the cab. In addition to the various switch groups and the two main transformers referred to above, the cab contains two air compressors driven by compensated motors of the same general type as the main driving motors. The circuits to these motors are con-

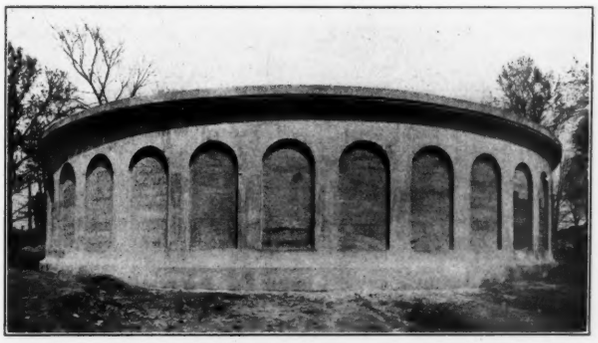


New Haven Electric Locomotive with A. C. Trolleys Raised.



Cos Cob Power House and Coal Dock; New York, New Haven & Hartford.

trolled automatically by the pressure of the air in the main reservoirs which are located underneath the locomotive. The four main traction motors, the high-potential transformers and the main circuit rheostats are cooled by air furnished at low pressure by means of two motor-driven centrifugal blowers which draw air through openings in the cab. The low-pressure air has two paths. One path passes first through the transformer and then to the rheostat. The other path goes directly to the motors. It enters the armature near the shaft, passes around and between the armature laminations, flows outward through the ventilating ducts in the field cores and reaches the outer air through perforated caps on the frame of the motor.



Concrete Water Reservoir at Cos Cob Power House.

Since a considerable volume of air is required for each motor and it is undesirable to cause the air to assume a high velocity, it was necessary to provide a large flexible conduit between the air passages on the cab and those on the motors proper. The flexible conduit is made of heavy canvas tubing which is reinforced with wire and given an accordion pleating. By the use of the air blast the temperature of the motors under load has been so decreased that the continuous rating is almost equal to the one-hour rating.

COS COB POWER HOUSE.

The initial single phase electrification comprises that portion of the New York division of the New York, New Haven & Hartford from Stamford, Conn., to the junction with the New York Central at Woodlawn, N. Y., 21 miles. From Woodlawn to the Grand Central Station the New Haven trains are operated over the tracks of the Harlem division of the New York Central by the New Haven electric locomotives, using direct current from the New York Central's third rail electric equipment. The power house at Cos Cob furnishes single-phase current for the operation of electric trains over the New Haven road and is also designed to deliver three-phase current to the Port Morris power house of the New York Central to compensate for the energy required to operate the New Haven trains over the lines of the New York Central.

The power house is adjacent to the main line of the railroad and on the bank of the Mianus river about one mile from Long Island sound. Coal can be delivered either by water or rail, and an unlimited amount of salt water for condensing purposes is available. By the erection of a dam in the river about a mile up-stream from the power house an abundant supply of pure boiler feed-water is obtained.

The general style of architecture of the power house building is Spanish Mission; the walls are built of plain-faced concrete blocks. The site selected was on solid rock, and this required blasting the excavation for the basement and the condenser intake and discharge flumes. The building walls, below the water-table, and the machinery foundations are monolithic concrete. The interior columns in the boiler room are of structural steel, but all other columns required in the building are of concrete blocks. The steel roof trusses over the turbine room are supported on concrete block pilasters formed in the building walls, while over the boiler room they are carried by the pilastered building walls and by the interior steel columns, which also support the boilers, the mechanical draft equipment and the stack. The front of the switchboard gallery, at the south end of the turbine room, is carried on concrete block columns which also support a reinforced concrete girder forming one of the crane runways. The other crane runway is formed by another reinforced concrete girder built into the partition wall between the engine room and boiler room, and is supported on pilasters formed in this wall. The basement floor is concrete, laid on the rock. All other floors in the building are of reinforced concrete; and the roof is of reinforced cinder concrete finished with Ludowici tile.

A self-supporting steel stack 13 ft. 6 in. in diameter extending to a height of 100 ft. from the engine room floor, is carried by the steel columns which support the fan room floor, leaving the space below, on the boiler room floor, entirely clear.

The turbine room is 60 ft. wide by 112 ft. long, and the switchboard occupies a space next the turbine room which is 25 ft. wide by 110 ft. long. The boiler room is 160 ft. long and 110 ft. wide.

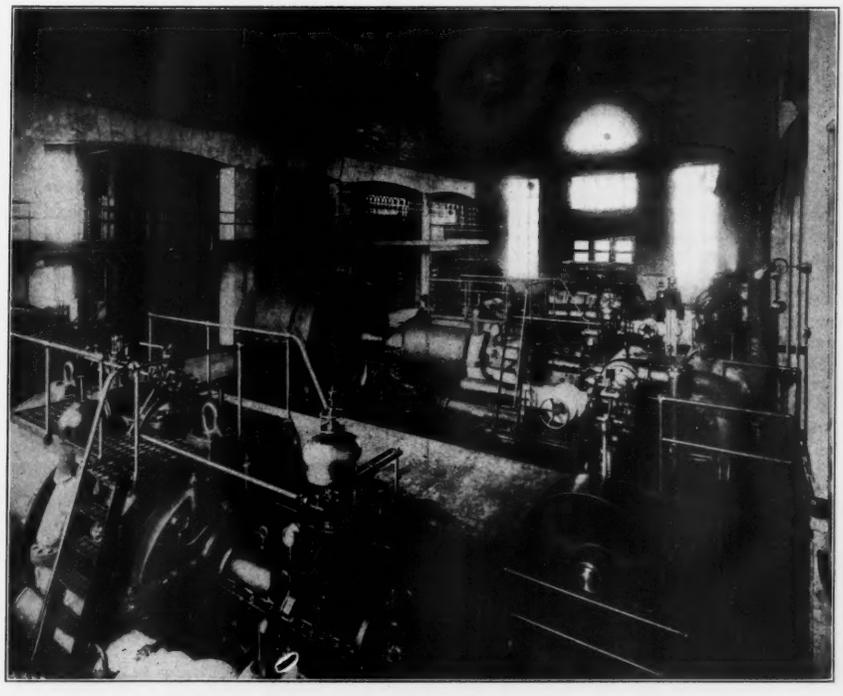
The initial generating equipment of the power house consists of three multiple expansion parallel flow Parsons steam turbines direct-connected to single-phase Westinghouse generators. Provision has been made for the installation of a fourth unit of corresponding size. The turbines are rated at 4,500 brake horse-power each and the generators at 3,000 k.w. each, at 80 per cent. power factor.

As the requirements necessitated the generation of three-phase current for delivery to the New York Central system as well as single-phase current for the operation of the electric locomotives over the New Haven railroad, the generators are wound for three-phase current but are arranged for the delivery of both three-phase and single-phase current. The turbines are operated at 1,500 revolutions per minute by steam at 200 lbs. pressure and 100 deg. superheat. The continuous overload capacity of the units is 50 per cent., and momentary overloads of 100 per cent. can be taken care of when operating condensing.

The generators are entirely enclosed by a casing into which air is drawn through suitable ducts from a fresh air chamber under the switchboard gallery, and from which the air is discharged through other ducts into the basement. This renders the operation of the generators practically noiseless.

The excitation of the generator fields is provided for by two 125-k.w. direct-current generators, direct-connected to Westinghouse engines; and one motor-driven exciter.

To prevent rapid deterioration of the brass condenser tubes by galvanic action a motor generator set has been installed and provided with suitable controlling apparatus for maintaining in each condenser a counter electro-motive force slightly in excess of the electromotive force due to galvanic action and the stray currents.



Interior of Turbine Room at Cos Cob Power House.

The initial installation of boilers consists of twelve 525-h.p. Babcock & Wilcox water-tube boilers set in batteries of two boilers each, and arranged with eight boilers on one side and four boilers on the other side of the boiler room separated by a 21-ft. firing floor. Provision is made for four additional boilers to take care of the fourth turbo-generator unit when installed. These boilers are equipped with Roney mechanical stokers and Babcock & Wilcox

superheaters and deliver steam at 200 lbs. gage pressure and 125 deg. superheat.

Under ordinary conditions the boiler feed water is delivered from the pump house at Mianus through a 10-in. main to a concrete reservoir of 600,000 gallons capacity just outside the power house. From this reservoir the water flows by gravity to two 13,000 gallon feed water tanks in the boiler room basement. These tanks also receive the discharge from the hot well pumps. The water is then drawn from these tanks by the feed pumps and delivered through the feed water heaters and the economizers into the boilers.

An auxiliary source of feed water supply is provided for by a connection to the mains of the Greenwich Water Company.

Four 14-ft. fans, direct-connected to horizontal high-speed engines, deliver the flue gases from the economizers to the stack, which is only of sufficient height to carry the gases away from the building.

All coal received by water is unloaded from barges by a steel derrick operating a clam shell bucket and delivering to a hopper of 15 tons capacity at a height of 55 ft. above the dock. From this hopper the coal is fed by gravity into a coal crusher and from the crusher it drops into steel cars where it is weighed. The cars are then drawn by cable up an inclined railroad into the boiler room through an opening near the roof. Two cars can be operated on this track, passing each other through an automatic turnout at the center. The cars discharge the coal into a hopper, from which it is delivered into two flight conveyors, extending the length of the boiler room. Openings in the bottom of the flight conveyors discharge the coal into spouts leading to the stoker hoppers of the boilers. The capacity of the flight conveyors is in excess of the amount of coal required to operate the boilers, and the surplus coal is discharged at the further end of the boiler room into a concrete storage bin below the boiler room floor. Coal received by rail is dumped from the car directly into a chute leading to this storage bin. When the boilers are to be supplied from this source the coal is discharged from the bin by gravity into a coal crusher, thence into a bucket conveyor located in a tunnel underneath the bin, by which it is delivered to the flight conveyors above the boilers, and thence through the chutes to the stoker hoppers. The cable railway and the conveyors are operated by three-phase induction motors, taking current from the station service line.

The ashes are disposed of by gravity from the dumping grates of the stokers into chutes leading to narrow-gage cars in the basement, by which they are at present carried to the low ground in the neighborhood of the power house and used for filling.

The Westinghouse Electric & Manufacturing Company were the contractors for the electric locomotives, catenary track equipment and turbo-generator units. Westinghouse, Church, Kerr & Company were the contractors for the Cos Cob power house and equipment. The task of determining and analyzing operating conditions and requirements was assigned to Calvert Townley, Consulting Engineer, and William S. Murray, Electrical Engineer, of the New Haven company, to whom credit is due for the design, supervision and execution of the details.

Cultivating Public Opinion.*

The drastic and to some extent revolutionary amendments to the Interstate Commerce law made last year, whatever their beneficial effect, must be much changed to meet even the quasi-approval of the general shipping public, which they were designed mostly to benefit. Shippers are beginning to point out the hardships of the law, and the decisions of the Commission threaten to paralyze their business and to bring greater destruction than under the worst of the old conditions. The Merchants' Association of Illinois, a representative body, has submitted a list of grievances against the new law. There has recently been held in New York a meeting of representatives of shippers of eastern states to formulate a protest against the practical working of the rate law.

Prosecutions with convictions have been secured under the Elkins law with beneficial results, yet that law has been in effect several years, and the government with its great resources could as easily have secured its evidence long ago as now for such convictions. An increase of power was desired, and if to gain this and the government allowed conditions which are now known to have prevailed, the responsibility should rest in the public mind where it belongs.

In the cases of recent convictions for payment of rebates, I believe the public reached the conclusion that all lines were equally guilty, and that they disobeyed the law by choice for their own special aggrandizement. Their attention was not directed to the fact that in most cases the railroads simply met conditions which they did not create and which they were powerless to control. This is not intended as a justification, but to call attention to the fact which the public had no way of hearing, that the lines which were perhaps really at fault were not those which were so severely punished. There is no justification for breaking the law, but there is justification for meeting conditions which are forced by the lax enforcements of such laws.

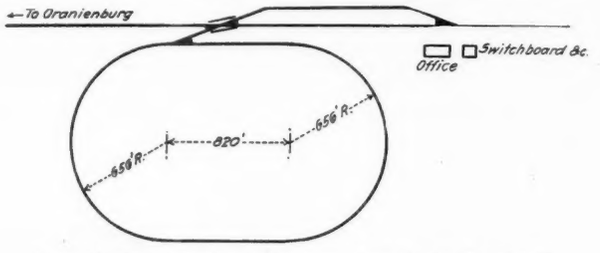
The railroads must take the public more closely into their confidence. There must be a bending backward of every official and every employee to satisfy as nearly as possible an exacting patronage, and to argue on sound premises in working for the rights conferred by constitution or charter. As public opinion has been outraged by the methods of high finance, care must be taken that the reasons for new capital should be given not only to the stockholders but to the public. If reorganizations are necessary, such necessity and expected results must be explained in detail. If this is an invasion of private rights, or tending to thwart the best results, it must, nevertheless, be done, or else there will be the same public distrust in the necessity and suspicion of private benefit at the expense of the public welfare. The fact must be brought home to the public mind that if the railroads are to be under government control, they have the right to expect the government to protect their interests as scrupulously as it looks after the interests of the public.

*From an address by C. A. Swope, Eastern Freight Agent, Louisville & Nashville.

Test Track of the Prussian State Railways.

Last December the Prussian State Railways put into operation near Oranienburg, 20 miles from Berlin, a special curved test track, a plan of which is shown in the accompanying drawing. It was built to carry out an exhaustive series of tests to determine: (1) The influence of different kinds of ballast and of different designs of ties on the vertical and horizontal alinement of track on curves; (2) efficiency of various forms of rail joints on curved and straight track, and (3) wear of rails on curved and straight track.

The track is oval, with two semi-circular curves of 656 ft. radius, joined by tangents 820 ft. long, giving a total circumference of about 5,762 ft., or nearly 1.1 miles. On the curves the superelevation is



Curved Test Track of the Prussian State Railways.

4.92 in. and the gage is widened 0.095 in. The elevation is tapered off 1:300, 1:500, 1:1000 and 1:1500 at the four points of tangency to determine the effect of the different tapers on the running of the cars.

Power is furnished by a single phase alternating current of 6,000 volts. The conductor is overhead, connection with the car being by means of a sliding contact.

Two motor cars of 58 tons each are provided. Each car has two 6-wheel trucks and is equipped with 4 motors. The motors develop 45 h.p. in ordinary steady running, with a maximum hourly capacity of 110 h.p., and they can develop for a short time 125 h.p. It is proposed to increase the capacity for steady running to 60 h.p., then by coupling on some freight cars it will be possible to run a train weighing 190 tons at a speed of 31 miles an hour for any length of time.

The train is run without a crew, the current being switched on and off from a small building provided with switchboards, meters, etc. With the exception of Sundays and holidays the train is to run 20 hours daily, the number of laps being automatically registered. At a speed of 31 miles the train would make 570 circuits of the track daily. With a train weighing 190 tons and running for 300 working days, upward of 32,000,000 tons will pass over every part of the track annually.

In these experiments the fundamental principle to be observed is that different constructions are to be compared only under identical conditions. Thus, if rail joints are to be tested, then ties and ballast must be the same; if ties are to be compared, rail joints and ballast must be the same; if different materials for ballast are under examination, rail joints and ties are to be the same.

The locomotive works of J. A. Maffei in Munich have built for the Bavarian State Railroads a locomotive capable of hauling a train weighing 165 tons at a speed of 93 miles an hour. This engine was tested July 1 and 2, and maintained for a prolonged time a speed of 96 miles an hour, which is declared to be the greatest speed ever made in Europe by a steam locomotive. It is a four-cylinder compound with 6-ft. drivers, Schmidt superheaters, and Westinghouse high-speed brakes.

GENERAL NEWS SECTION

NOTES.

The general storehouse of the Erie at Susquehanna, Pa., was destroyed by fire on the morning of August 14.

The State Railroad Commission of Wisconsin has ordered a reduction of 20 to 25 per cent. in freight rates on live stock from all parts of the state to Milwaukee.

Mrs. Russell Sage has given the sum of $50,000 for a building for the railroad Young Men's Christian Association at Long Island City, N. Y. The railroad company will give the ground for the building.

The railroads and the Minnesota state railroad commission have agreed that Duluth, St. Paul and Minneapolis shall be the only "terminal" points in the state at which, under the law, cars must be supplied within 48 hours after being ordered.

The State Railroad Commissioners of South Dakota, at their regular meeting, on August 29, will consider the question of reducing passenger fares in the state to 2½ cents a mile, in accordance with the recent act of the legislature.

On August 9 the Grand Jury in the Federal Court at Jamestown, N. Y., reported indictments against the Standard Oil Company, the New York Central & Hudson River Railroad and the Pennsylvania Railroad for making illegal rates on oil from Olean, N. Y., to points in Vermont.

In the United States Court at Minneapolis, Aug. 10, the Wisconsin Central Railway was fined $17,000 for paying rebates. This was in the suit in which the company was convicted last April. Burton Johnson and G. T. Huey, freight officers of the road, were fined $2,000 and $1,000 respectively.

A strike of the Brotherhood of Railway Trainmen members employed by the Colorado & Southern, which had disturbed freight traffic for a week, was settled August 13 by the granting of one cent an hour increase to yardmen and switchmen. It was agreed to arbitrate the demand for another cent.

Against the protest of initial lines in California, Eastern roads have decided to make a charge of $5 a car on shipments of citrus and deciduous fruits, after two diversions in transit. Heretofore there has been no restriction, and at times cars have been diverted five or six times before the fruit was finally disposed of.

In Alabama the Southern Railway and the St. Louis & San Francisco have agreed with the officers of the state to put in effect the laws passed this year reducing passenger fares to 2½ cents a mile, and reducing freight rates on 110 commodities. The agreement provides for the early reference of these laws to the courts of last resort to settle their constitutionality.

The National Industrial League claims now to have a membership of 20,000 firms, although only one month old. This is a combination of shippers which, it is declared, will contest the recent ruling of the Interstate Commerce Commission that railroads have the right to publish notice in their through tariffs that the initial road reserves the right to route the freight beyond its own lines.

The railroad commissioners of Indiana, who are seeing to the enforcement of the law recently passed in that state requiring a certain minimum number of men in the crew of each train, find that some of the railroads propose to class the porter of a passenger train as a member of the crew and thus avoid the expense of employing a higher grade man to comply with the law. The Brakemen's Brotherhood is vigorously opposing this interpretation of the statute.

Judge Grosscup, in the United States Circuit Court at Chicago, Aug. 12, issued the final order turning over to the Chicago Railways Company all the street railways on the north and west sides of the city, which heretofore have been operated under the name of the Chicago Union Traction Company. An application has been made for an appeal from the order in behalf of the holders of the first mortgage bonds of the North Chicago Street Railway. The hearing of the appeal is set for next Monday.

The Long Island Railroad has prepared statistics to show that in the matter of protecting grade crossings that company has done better than any other prominent road in the state of New York. On all the steam railroads in the state there are 6,793 unprotected crossings, 1,940 protected crossings, 714 overhead and 930 undergrade crossings. The percentages of crossings protected by gates, flagmen or bells are as follows: Long Island road, 52 per cent.; D., L. & W., 43; New York Central, 41; Erie, 36; Delaware & Hudson, 30; N. Y., O. & W., 30. On the Long Island 22 per cent. of all crossings are either above or below grade as against 10 per cent. on the D. & H., 13 per cent. on the D., L. & W., 13 per cent. on the Erie, 12 per cent. on the Lehigh Valley, 19 per cent. on the N. Y. C., and 16 per cent. on the N. Y., O. & W. On all the roads of the state there are 8,733 crossings at grade. Estimating the average cost of changing each one at $50,000 each, the cost of abolishing all grade crossings in the state would be in the neighborhood of 500 million dollars.

The Nebraska State Railroad Commission has filed with the Interstate Commerce Commission a complaint of exorbitant rates on coal over the Union Pacific from the mines of Wyoming to points in Nebraska. The complaint recommends and asks that a reduction of $1.50 a ton be ordered from the mines to Omaha, a reduction of 25 per cent. Further west, reductions of from 50 to 65 per cent. are asked. In the past the Union Pacific has charged a blanket rate to all Nebraska points from Wyoming, points only 300 miles distant being made to pay the same as those 800 miles from the mines.

Judge Lacombe, in the United States Circuit Court at New York Aug. 10 denied the motion of the Delaware, Lackawanna & Western Railroad for a preliminary injunction restraining the Interstate Commerce Commission from carrying out its order directing the railroad to transfer tank cars containing petroleum to the dock of Preston & Davis, independent dealers in Brooklyn. The road claimed that the danger of fire on the Brooklyn dock prevented it from doing this business for Preston & Davis, but the judge holds that the danger can be overcome by sufficient watchfulness and care, and leaves all questions to be decided at the final hearing.

Prof. Benjamin Succeeds Prof. Goss at Purdue.

Prof. Charles Henry Benjamin has been appointed Dean of the Schools of Engineering of Purdue University, to succeed Dean W. F. M. Goss, who resigned to accept a similar appointment at the University of Illinois. Professor Benjamin has been professor of mechanical engineering at Case School of Applied Science, Cleveland, Ohio, since 1889, prior to which time he was for three years engaged in engineering practice and for six years as instructor and professor of mechanical engineering in the University of Maine, of which institution he is a graduate. He is well known as a teacher, investigator, author and engineer. Prof. Benjamin is a member of the American Society of Mechanical Engineers and has contributed a number of papers on power transmission and flywheels to that society.

Explosions.

At Essex, Ont., Aug. 10, half a carload of nitroglycerine exploded and did damage estimated at $200,000. Two men were killed, three were fatally hurt and 50 were slightly injured. The explosion wrecked every building in the town and was felt for 20 miles around. The car containing the explosive was side-tracked near the Michigan Central station. When a train was being made up a brakeman discovered that the explosive was leaking in the car. He was trying to stop the leak when the explosion came. The new stone station, the freight sheds, Green's elevator and Fagin & Ritchie's mill were wrecked.

At Boulder, Colo., on the same day a fire in the Colorado & Southern station destroyed the building and a lot of freight and spread to a powder house containing 1,000 lbs. of dynamite. This exploded, injuring about 100 persons. Two of the injured will die. The property loss is estimated at $250,000.

Exhibit of the American Locomotive Company at Jamestown.

The American Locomotive Company has an exhibit at the Jamestown Exposition, which includes two locomotives for Southern railroads built at the Richmond, Va., works. Both of these are consolidation locomotives, one for the Chesapeake & Ohio, with a total weight of 208,600 lbs., and the other for the Southern Railway, weighing 202,800 lbs. Both locomotives have Walschaert valve gear. There is also on exhibition a four-wheel-connected saddle-tank locomotive weighing 36,000 lbs., for use by contractors, on logging roads, in industrial plants, and anywhere on sharp curves and light rails. The Atlantic Equipment Company is exhibiting the latest design of the Atlantic steam shovel. The hoisting machinery of this shovel is mounted directly on the boom, so that no guide sheaves are necessary, and the power can be applied with the least possible loss. The hoisting is done by direct wire rope with one sheave instead of by chain with from five to seven sheaves. In the construction of the dipper the bail and sheave have been discarded and the double hoisting rope attached directly to the back of the dipper in such a way that the lines of force meet in line with the strain applied to the teeth. This shovel is being exhibited with a patent

dump car made by the Oliver Manufacturing Company. The car is elevated on a trestle representing a bank, so that the shovel has a lift of over 16 feet.

Compulsory Block Signals in Indiana.

The State Railroad Commission of Indiana has ordered all railroads whose earnings are in excess of $7,500 a mile, to proceed to equip their lines with block signals and to have them completed by July, 1909. The Commission asks for an immediate reply. The Commission's expert will confer with the general managers as to the kind of systems that must be put in.

Erie Canal Contract.

The contract for enlarging the Erie Canal from Oneida Lake, N. Y., westerly to Mosquite Point bridge on the Seneca river, has been awarded to the Stewart, Kerbaugh & Chanley Company, of New York City, whose bid was $3,395,766. This was on the second call for bids. The first time bids were called for none were received. The accepted bid was in excess of the engineers' estimate but under these circumstances was accepted by the state of New York.

Twenty Passengers Killed in Germany.

According to a press despatch of August 6, a passenger train, drawn by two engines, was derailed near Posen, Prussia, on the evening of that day and 20 or more persons were killed; while a large number were injured.

University of Iowa Engineering Prize.

An annual prize of $100 has been established in the College of Applied Science of the State University of Iowa for the best thesis submitted for the first degree in engineering. The prize is to be known as the "Thomas J. Cox Prize in Engineering," in memory of the father of the donor, who is Arthur J. Cox, of Iowa City, a graduate of the engineering department.

Railroad Taxes in New Jersey.

The Supreme Court of New Jersey has sustained the constitutionality of the Perkins act of 1906, providing for the taxing of so-called main stem railroad property, including franchise and tangible personal property. Under the present act main stem property is taxed for state purposes at the average rate of the state tax, or [this year] $1.80 per $100 valuation. Prior to its passage, this class of railroad property was taxed at an arbitrary rate of 50 cents per $100 of valuation. In 1905 the main stem tax amounted to $950,991. In 1906, under the Perkins act, it was $3,503,529. Under the decision rendered a few days earlier on the "second class" property tax, combined with the present decision, the taxes on railroad property in the state will be increased between $4,000,000 and $5,000,000 a year.

British to Build Railroad in Africa.

Speaking in the British House of Commons, Winston Churchill, Under Secretary of the Colonial Office, announced last week that the government had decided to build 400 miles of railroad in northern Nigeria, from Baro by way of Bida, Zungeru and Zaria to Kano, with the object of developing the colony, and especially the cotton growing industry. The work of construction will be entrusted to Lieut.-Col. Sir Edouard P. C. Girouard and will take four years.

Japanese Railroad Visitors.

Seven engineers sent out by the Japanese government have recently arrived at San Francisco to study American railroads, with particular regard to methods of construction. This is because the Japanese government is to undertake the building of several thousand miles of new steam railroads. The party includes three railroad engineers, two railroad managers, one harbor engineer and one steamship engineer.

INTERSTATE COMMERCE COMMISSION RULINGS.

Higher Rates for Fast Service.

Commissioner Clark has announced the decision of the Commission in the case of the American Fruit Union, of Cincinnati, Ohio, v. Cincinnati, New Orleans & Texas Pacific. It appeared in this case that in conference between officials of the carrier and representatives of certain of its patrons, it was agreed that higher rates would be charged and paid for the transportation of strawberries in consideration of special expedited trains on which they would be hauled and by which they would be delivered for the early morning market; but on account of reconstruction and improvement work along the line of the carrier it was unable to furnish the expedited service agreed upon and which it had furnished for several years. The shipper contended that if the expedited service was not provided the higher rate should not obtain, and the Commission held that where an unusually high rate is charged because and in consideration of a special and expedited service it is the duty of the carrier to provide such service or to cease and desist from charging the higher rate. "This principle is recognized in contracts between the Federal Government and the railroads for fast mail service and by the railroads in connection with their excess-fare limited passenger trains. In both instances carriers forfeit a part of the compensation if they fail to make the time agreed upon." The defendant's rate on strawberries in carloads, under refrigeration, from Chattanooga and Oakdale, Tenn., to Cincinnati, Ohio, was found unreasonable and reduction was ordered. Reparation was also awarded to injured shippers because of such unreasonable rate on strawberries during the season of 1907. The rate of 27 cents per crate of 24 qts. was ordered to be reduced to 22 cents per crate.

Published Rates Are Laws.

The Commission, in an opinion rendered by Commissioner Harlan, has announced the decision of the Commission in the case of the A. J. Poor Grain Co. v. Chicago, Burlington & Quincy et al. In this case the Commission decided that a rate on wheat of 75 cents per 100 lbs. from Nebraska common points to California terminals via. the C., B. & Q. through Denver and thence via the Union Pacific and Southern Pacific to destination, is unreasonable and excessive. It is manifestly so, as compared with the through rate of 55 cents on corn over that route, and a through rate of 55 cents on both corn and wheat from Nebraska points via the Union Pacific and Southern Pacific to those destinations. Any rate on wheat over the route in question from these points of origin to California terminals in excess of 65 cents per 100 is held to be unreasonable. Complainant was awarded reparation on his shipments on that basis, but was not given an order of reparation on his shipment to Reno, Nev.

The published rate governing transportation between two given points, so long as it remains uncanceled, is as fixed and unalterable either by the shipper or by the carrier as if that particular rate had been established by a special Act of Congress. When regularly published, it is no longer the rate imposed by the carrier, but the rate imposed by law. Regardless of the rate quoted or inserted in a bill of lading, the published rate must be paid by the shipper and actually collected by the carrier. Failure on the part of the shipper to pay or of the carrier to collect the full freight charges, based on the lawfully published rate for the particular movement between two given points, constitutes a breach of the law and will subject either one or the other, and sometimes both, to its penalties. Not even a court may interfere with a published rate or authorize a departure from it when it has voluntarily been established by the carrier. If a carrier, contrary to shipper's instructions, forwards cars by a more expensive instead of a cheaper route, or, without any instructions, sends the cars by a more expensive route, such action is *prima facie* without justification and constitutes a fair basis for reparation; but if the shipper gives definite instructions to move the cars by the more expensive route, the carrier is relieved of the obligation to forward by the cheaper route. Shippers along the line of an interstate carrier are entitled to have their products moved in either direction at reasonable rates, and the Commission cannot agree that a carrier may establish prohibitive rates on any commodity on the ground that it is not desirable traffic for that carrier.

TRADE CATALOGUES.

Rock Island Employees' Magazine.—The second number of this monthly periodical of the employees of the Rock Island system is much larger than the initial number, and has an appropriate cover design. There are articles on "Growth of the Rock Island Lines," by Geo. H. Crosby, Treasurer; "Get the Business," by E. F. Strain, Division Freight Agent; "Chicago Terminal District Telephone System," by J. G. Jennings, Superintendent of Telegraph. There is also a plan of the organization of the Rock Island lines; a description of some new consolidation locomotives recently received; a roll of honor "for doing more than duty"; plans and a description of a moderate priced cottage, it being the intention to show one of these a month; miscellaneous items of interest, and notes from important points on the system.

Dominion Atlantic Railway.—"Nova Scotia, the Land of Summer Rest," and "Vacation Days in Nova Scotia" were recently issued by the passenger department. The first is the 1907 edition of a former publication. It is charmingly written and has excellent photographs. It describes the seacoast passed by the steamers on the trip from New York to Yarmouth, N. S., then the west coast of

Nova Scotia and across the island to Halifax. The second booklet describes similar country from the standpoint indicated in the title, being rather a guide to those who spend some time in the region than for casual tourists.

Locomotive Cranes, Grab Buckets, Etc.—The McMyler Manufacturing Co., Cleveland, Ohio, has a new catalogue of locomotive cranes, bridge conveyors, grab buckets and car dumpers. This company designs and build locomotive stationary or revolving cranes; car dumping machines; elam-shell buckets, including special styles for ore; orange-peel buckets, railroad coaling and ash-handling stations, coal and ore unloaders, slag-handling machinery and bridge conveyors. The catalogue illustrates and describes this product.

Reinforced Concrete.—Part IV. of "Trussed Concrete Illustrated," being published serially by the Trussed Concrete Steel Co., Detroit, Mich., shows the Kahn system of reinforced concrete construction as applied to hotels, residences and apartment houses. The illustrations include the Marlborough-Blenheim and Traymore hotels at Atlantic City, N. J.; the Murphy hotel and apartments, Richmond, Va.; Perry apartments, Seattle, Wash., and several large residences in different cities.

Ideal Power.—The July number of the Chicago Pneumatic Tool Co.'s magazine has for leading articles, "Rock Drills in Quarry and Tunnel Work" and "Locomotives for France Built in the United States on the Metric System." There are also pictures of the two new Cunard Line steamships "Lusitania" and "Mauretania," on which Duntley electric drills were used. Other matter includes notes of interest and reprints of articles from other journals.

MANUFACTURING AND BUSINESS.

The receivers of Milliken Brothers, Inc., are continuing in full operation the structural and ornamental departments of the company. The main office is at 11 Broadway, New York, and the works are at Milliken, Staten Island, New York.

F. D. Laughlin, formerly Vice-President of the Atlantic Brass Co., Richmond, Va., has been appointed eastern sales manager of the Pittsburg Pneumatic Co., Canton, Ohio, with office at 90 West street, New York City, succeeding Glenn B. Harris.

Isham Randolph, Consulting Engineer, and until recently Chief Engineer, of the Sanitary District of Chicago, and builder of the Chicago drainage canal, has opened an office as Consulting Engineer in the American Trust & Savings Bank Building, Chicago.

The Terry Railway Equipment Co., Monadnock Block, Chicago, has been organized by George N. Terry, formerly with the Safety Car Heating & Lighting Co., and recently with the Ryan Car Co., Chicago, to deal in second-hand cars and locomotives and in railroad supplies. George N. Terry is Manager and E. B. Terry, Secretary.

The American Locomotive Company has recently received an order for 101 4-wheel motor trucks for the Brooklyn Rapid Transit Company. They will follow closely M. C. B. standards, and embody as far as possible the practices of locomotive construction, thereby insuring strength combined with easy riding qualities, the two essential characteristics of the motor truck of the present day.

The Italian government has made a contract with the owners of the patent of the Rueping process for treating timber to have the ties used in future on the government railroad system of Italy, which includes almost all of the railroad mileage of the country, treated by that process. During the first year that the contract is in operation about 1,500,000 Rueping treated ties will be laid. C. Lembcke & Co., 78 Wall street, New York, are the American agents for this process.

Iron and Steel.

The Atchison, Topeka & Santa Fe is reported to have ordered 15,000 tons of rails from the Colorado Fuel & Iron Co., and 8,000 tons from the Maryland Steel Co., both for immediate delivery.

Orders are pending for about 25,000 tons of steel for railroad, bridge and track elevation work. The Chicago, Milwaukee & St. Paul recently gave an additional order for 1,700 tons for a viaduct to the McClintic-Marshall Construction Co.

The Northern Pacific has given a supplementary order for 5,000 tons of rails for early shipment. The Idaho & Northern has ordered 6,000 tons for 1908 delivery, and Chicago reports state that 10,000 tons for delivery next year have been ordered by a new road. Miscellaneous small orders from 1,000 to 3,000 tons have been given aggregating 10,000 tons for this year's shipment.

OBITUARY NOTICES.

Israel Munson Spellman, who was President of the Boston & Maine for 30 years from 1839 to 1869, died on August 6 at Marblehead, Mass., at the age of 91.

Dr. William Thomson, the distinguished Philadelphia physician, ophthalmologist and pioneer in the field of antiseptic surgery, who died recently at the age of 74, was a pioneer in the testing of railroad men's eyes, having prepared the first regulations for this work on the Pennsylvania Railroad. He wrote important monographs on the subject, and devised the "Thomson stick," for use in testing for color blindness by means of yarns. Dr. Thomson was a brother of the late Frank Thomson, President of the Pennsylvania Railroad.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Alabama & Vicksburg.—See New Orleans & North-eastern.

Cape Girardeau.—See Chester, Perryville & Ste. Genevieve.

Chester & Saline Valley.—See Chester, Perryville & Ste. Genevieve.

Chester, Perryville & Ste. Genevieve.—Ralph H. Schultz has been appointed Auditor and Assistant General Freight and Passenger Agent, with office at Cape Girardeau, Mo.

Cincinnati, New Orleans & Texas Pacific.—Thomas Carr Powell, Vice-President of the Southern Railway, in charge of the St. Louis-Louisville lines, who was recently elected Vice-President of the Cincinnati, New Orleans & Texas Pacific and of the Alabama Great Southern, returns to his native city and first railroad in taking up his headquarters at Cincinnati. There he was born on September 5, 1865, and at the age of 19 began railroad service as a mail clerk on the Cincinnati, New Orleans & Texas Pacific. He next became chief rate clerk and chief clerk to the Traffic Manager and, on June 1, 1893, was appointed Assistant General Freight Agent. In 1895 he went to the Southern Railway as chief clerk to the General Freight Agent in charge of the rate and tariff department. He was appointed General Freight Agent of the Southern Railway and of the Northern Alabama in 1898 and, in 1899, Assistant Freight Traffic Manager of those railroads. In 1902 he became Freight Traffic Manager and, in 1905, Fifth Vice-President of the Southern Railway in charge of traffic in the West and of the operating department of the St. Louis-Louisville lines. With the rearrangement of the executive officers of the Southern after the death of Mr. Spencer he became Vice-President at St. Louis in direct charge of the St. Louis-Louisville lines. He goes to the Queen & Crescent as Vice-President in charge of the operating, purchasing and traffic departments.

Thomas C. Powell.

Great Northern.—F. H. McGuigan, First Vice-President, has resigned.

New Orleans & North-eastern.—Larz A. Jones, Vice-President, is also Comptroller of the New Orleans & North-eastern, the Alabama & Vicksburg, and the Vicksburg, Shreveport & Pacific. H. H. LeRoy, Assistant Auditor, has been appointed Assistant Comptroller.

St. Joseph & Grand Island.—Frederick C. Uhlman, Auditor, has resigned. See Virginian Railway.

Vicksburg, Shreveport & Pacific.—See New Orleans & North-eastern.

Virginian.—Frederick C. Uhlman, Auditor of the St. Joseph & Grand Island, has been appointed Auditor, with office at Norfolk, Va.

Virginia & Southwestern.—H. W. Oliver, assistant to the engineer of construction of the Louisville & Nashville, has been appointed Secretary and Treasurer of the Virginia & Southwestern and the Virginia Iron, Coal & Coke Co.

Operating Officers.

Alabama & Vicksburg.—See New Orleans & North-eastern.

Atlantic Coast Line.—G. B. McClellan, Superintendent at Rocky Mount, N. C., has been appointed Superintendent at Fayetteville, N. C. F. M. Doar, Superintendent at Savannah, has been appointed Superintendent of Transportation of the new Second division. J. C. Murchison, Superintendent at Wilmington, N. C., has been appointed Superintendent at Charleston, S. C. G. D. Pugh, Superintendent at Charleston, S. C., has been appointed Superintendent at Savannah, Ga. R. A. McCranie has been appointed Superintendent at Waycross, Ga. S. B. Hennett has been appointed Superintendent at Montgomery, Ala. T. E. Hansell, Acting Superintendent at Waycross, Ga., has been appointed Superintendent at Newberry, Fla.

Birmingham Southern.—F. Kestler, Assistant Superintendent of the Louisville & Nashville at Birmingham, Ala., has been appointed General Superintendent.

Boston & Maine.—See St. Johnsbury & Lake Champlain.

Chicago & North-Western.—C. T. Dike, Resident Engineer at Pierre, S. Dak., who has had charge of the construction of the new Pierre-Rapid City line, has been appointed Superintendent of a new division, which consists of this new line, with headquarters at Pierre.

Chicago, Cincinnati & Louisville.—W. B. Allen, Superintendent of Telegraph and Chief Train Despatcher, has been appointed Trainmaster at Peru, Ind., succeeding G. S. Cooke, resigned. E. C. Murphy succeeds Mr. Allen, with office at Peru.

Houston & Texas Central.—W. E. Langley has been appointed Trainmaster, with office at Houston, Tex.

Illinois Central.—J. D. Brennan, Trainmaster at Carbondale, Ill., has been transferred to Champaign, Ill. George W. Berry succeeds Mr. Brennan, with office at Carbondale, Ill.

Louisville & Nashville.—James A. Morrison, Trainmaster at Birmingham, Ala., has been appointed Assistant Superintendent of the Birmingham Mineral division, the Alabama Mineral division and the South and North Alabama Railroad, with headquarters at Birmingham, Ala., succeeding F. Kestler, resigned. See Birmingham Southern.

New Orleans & North-eastern.—Edward Ford, Superintendent of the Alabama & Vicksburg and the Vicksburg, Shreveport & Pacific, has been appointed General Manager of the New Orleans & North-eastern, Alabama & Vicksburg and Vicksburg, Shreveport & Pacific, succeeding D. E. Curran, now President of these companies. Walter E. Harvey, Assistant Superintendent of the Alabama & Vicksburg and Vicksburg, Shreveport & Pacific, succeeds Mr. Ford as Superintendent of the Alabama & Vicksburg. H. B. Hearn, Assistant General Freight Agent of the three roads at Shreveport, La., succeeds Mr. Ford as Superintendent of the Vicksburg, Shreveport & Pacific. A. J. Chapman, Commercial Agent at Dallas, succeeds Mr. Hearn as Assistant General Freight Agent, with headquarters at Shreveport.

New York, New Haven & Hartford.—The office of Joseph H. Dunn, Assistant Superintendent of the Berkshire and Naugatuck divisions, has been moved from New Haven, Conn., to Waterbury.

Northern Pacific.—T. E. Coyle, Assistant Trainmaster at Tacoma, Wash., has been appointed Trainmaster, with office at Tacoma, succeeding F. E. Willard, promoted.

Oregon Short Line.—John McCarty has been appointed Trainmaster of the sixth, seventh and eighth districts of the Salt Lake division, with headquarters at Mina, Nev., succeeding F. C. Smith, resigned.

St. Johnsbury & Lake Champlain.—F. C. Mayo has been appointed Assistant Superintendent, succeeding George W. Cree, now Assistant Superintendent of the Boston & Maine at Lyndonville, Vt.

Seaboard Air Line.—S. B. Zartman, Trainmaster at Jacksonville, Fla., has been appointed Superintendent of Terminals at Jacksonville. E. R. Teague succeeds Mr. Zartman.

Vicksburg, Shreveport & Pacific.—See New Orleans & North-eastern.

Virginia & Southwestern.—Joseph W. Bailey has been appointed Car Accountant, with office at Bristol, Va.-Tenn.

Traffic Officers.

Alabama & Vicksburg.—See New Orleans & North-eastern under Operating Officers.

Atchison, Topeka & Santa Fe.—D. L. Meyer, Traffic Manager of the Southern Kansas Railway of Texas and the Pecos Valley & Northeastern, has been appointed General Freight and Passenger Agent of the Southern Kansas of Texas and of the Eastern Railway of New Mexico which recently bought the Pecos Valley & Northeastern. His office is at Amarillo, Tex.

Great Northern.—D. J. Black, General Agent of the Freight Department at Minneapolis, has been appointed General Agent at Spokane, Wash., succeeding A. H. Campbell, who went to the Spokane International. T. J. McGaughey, Commercial Agent at Cleveland, succeeds Mr. Black.

Gulf, Colorado & Santa Fe.—W. L. Alexander has been appointed General Claim Agent, with headquarters at Galveston, Tex., succeeding T. J. Lee, resigned on account of ill health.

Missouri Pacific.—Henry C. Townsend, General Passenger and Ticket Agent, has resigned on account of ill health.

C. E. Wager, Commercial Agent at Atchison, Kan., has been appointed General Agent at Pueblo, Colo., succeeding J. B. Trimble, now General Agent at Pittsburg, Pa.

New Orleans & North-eastern.—See New Orleans & North-eastern under Operating Officers.

Vicksburg, Shreveport & Pacific.—See New Orleans & North-eastern under Operating Officers.

Engineering and Rolling Stock Officers.

Chicago & Alton.—C. G. Delo, Engineer of Maintenance of Way at Kansas City, Mo., has been transferred to Bloomington, Ill., succeeding W. C. Causey, now Superintendent at Bloomington.

Chicago, Burlington & Quincy.—E. D. Andrews has been appointed Master Mechanic of the Sterling division, Lines West of the Missouri river, with headquarters at Sterling, Colo., succeeding F. Newton, resigned.

Hocking Valley.—M. A. Kinney, roundhouse foreman of the Baltimore & Ohio at Newark, Ohio, has been appointed Master Mechanic of the Hocking Valley, with headquarters at Columbus, Ohio, succeeding E. J. Powell, resigned.

Louisville & Nashville.—E. L. Trowbridge has been appointed assistant to the engineer of construction at Louisville, Ky., succeeding H. W. Oliver, resigned. See Virginia & Southwestern under Executive, Financial and Legal Officers.

Mexican Central.—B. F. Elliott has been appointed Assistant Master Car Builder, with headquarters at Aguascalientes.

Missouri Pacific.—M. M. Meyers, formerly on the Denver & Rio Grande, has been appointed Master Mechanic, with office at De Soto, Mo., succeeding A. S. Grant.

Santa Fe Central.—G. A. Baker has been appointed Superintendent of Motive Power, with office at Estania, N. Mex., succeeding T. J. Tonge.

Special Officers.

Chicago, Rock Island & Pacific.—Dr. Hermann von Schrenk has been appointed Supervisor of Timber Preservation, with headquarters at Tower Grove and Flad avenues, St. Louis, Mo. The Supervisor of Timber Preservation will have direct charge of the inspection of the preservative treatment given ties and timber, and will act in an advisory capacity in any and all matters pertaining to increasing their durability.

LOCOMOTIVE BUILDING.

The Northwestern Pacific has been figuring on buying new locomotives.

Edward Haynes, 18 Broadway, New York, is in the market for small locomotives for canal and plantation work.

The Temiskaming & Northern Ontario has ordered six six-wheel switching locomotives from the Canadian Locomotive Co., Kingston, Ont., for February, 1908, delivery.

The Atchison, Topeka & Santa Fe is said to have ordered a number of 16-wheel Mallet compound locomotives to be used on the mountain grades of the La Junta division.

The Intercolonial Railway, as reported in our issue of July 19, has ordered 10 passenger locomotives from the Locomotive & Machine Co., of Montreal, and 22 consolidation and three switching locomotives from the Canadian Locomotive Co., Kingston, Ont.

CAR BUILDING.

The Canadian Pacific recently ordered 500 box cars from Barney & Smith.

Edward Haynes, 18 Broadway, New York, is in the market for small cars for canal and plantation work.

The Toledo, Fostoria & Findlay (*Electric*) has ordered four interurban motor cars from the Niles Car & Manufacturing Co.

The New York City Railway has ordered 100 double-truck street cars of the "pay-as-you-enter" type from the J. G. Brill Co.

The Virginian is reported to have ordered 10 steel dump cars of 60 tons capacity from the Atlas Car Manufacturing Co., Pittsburg.

The Wisconsin Steel Company has ordered 15 steel underframe gondola cars of 100,000 lbs. capacity from the Western Steel Car & Foundry Co.

The Detroit & Toledo Shore Line denies having ordered 400 coal cars from the American Car & Foundry Co., as reported in the *Railroad Gazette* July 26.

The San Pedro, Los Angeles & Salt Lake, as reported in the *Railroad Gazette* of August 9, has ordered 100 tank cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The Erie is reported to have re-entered an order for 3,000 box cars placed last February with the American Car & Foundry Co., as reported in our issue of Feb. 15, and which was canceled in June.

The Chicago, Milwaukee & St. Paul is turning out 24 steel underframe box cars a day at its West Milwaukee shops, these cars being a part of an order for 3,000 cars placed last spring, as reported in our issue of March 15.

RAILROAD STRUCTURES.

AUSTIN, TEX.—Local reports state that the Missouri, Kansas & Texas has plans made for extensive terminal improvements in a number of cities in Texas, including Fort Worth and Dallas, where about $600,000 is to be spent enlarging the present terminals. Two-thirds of this will be used for repair shops and a roundhouse, and for laying yard tracks at Fort Worth.

CHICAGO, ILL.—Preliminary work on the Chicago & North-Western's new passenger station has been begun. One-half of the property for the site has been bought, and the rest will be bought this year. Actual construction work will be begun early next year. The buildings are being removed between Canal and Clinton streets and north of Madison street, where the station will be built.

GLOBE, ARIZ.—The Southern Pacific has plans ready for putting up a new passenger station, for which a site has been bought. The station is to be used by the Gila Valley, Globe & Northern. The cost of the improvement will be about $100,000.

TRINIDAD, COLO.—Final arrangements have been made by the Atchison, Topeka & Santa Fe to make improvements here at a cost of $60,000. The work includes a new freight house, a roundhouse and a coal chute. A new side track will also be laid.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ATLANTA, BIRMINGHAM & ATLANTIC.—This company is to build from Bone's Gap, Ala., to Adamsville, penetrating a coal district. This line is a companion to the line from Bessemer to the new coal town of Mulga, and the proposed line from Birmingham to Gate City, where a rolling mill district is entered. The Birmingham district branches of the A., B. & A. will cover about 25 miles, and will give an entrance into many important industrial centers.

CENTRAL KENTUCKY TRACTION.—This company has issued $300,000 bonds and executed a mortgage for $250,000 to secure funds to finish the construction of its lines from Lexington, Ky., east to Winchester, 20 miles, and south to Nicholasville, 15 miles.

CHICAGO, BURLINGTON & QUINCY.—According to reports, this company has filed plans for its proposed extension in Wyoming. The route is from Guernsey northwest along the North Platte river to Douglas, thence west to the Shoshone Indian Reservation, about 200 miles. Surveys reported under way.

CHICAGO, MILWAUKEE & ST. PAUL.—President Earling is quoted as saying that work on the Pacific extension will be pushed to completion as fast as men and machinery can accomplish the task. Several thousand additional men are to be put on work to have the line finished to Butte next May. He does not say when work will begin on the Seattle division. The company is soon to begin work on the 8,000-ft. Bitter Root tunnel and on the 10,000-ft. tunnel in Snoqualmie Pass.

CHICAGO, ROCK ISLAND & PACIFIC.—The Carrolton-Irving cut-off, it is expected, will be finished and ready for operation in a few weeks. The new line will be 11 miles long and will connect Irving, Tex., which is on the Fort Worth-Dallas line of the Rock Island, with Carrolton, on the St. Louis & San Francisco. (July 26, p. 111.)

CORVALLIS & ALSEA RIVER.—Incorporated in Oregon with a capital of $150,000 to build a line from Corvallis, southwest via Alsea, thence south to Blachly in the Lake creek district, about 40 miles. Stephen Carver, B. W. Johnson, V. E. Watters, A. Fischer, E. R. Bryson and F. L. Miller, of Corvallis, are directors.

FORT WORTH & RIO GRANDE.—See St. Louis & San Francisco.

GULF, COLORADO & SANTA FE.—Plans reported made for extensive improvements at Port Bolivar, Tex., which is to be an important lumber exporting point. A pier 300 ft. wide and 1,200 ft. long is to be constructed and barges are to be used to transport passenger trains across the bay to Galveston. The Gulf & Interstate division, which runs from Bolivar to Beaumont, connecting at this point with the line north to Center, is building a connecting line from Center to Timpson, which will give a connection with the Texas & Gulf. Plans are ready for extending the T. & G. north from Longview to a connection with the Santa Fe's Kansas City line at a point in the Indian Territory. When these connecting links are finished the Santa Fe will have a shorter route from Kansas City to Galveston.

GULF, PLAINVILLE & NORTHERN.—This company, chartered to build 60 miles of line from Plainville, Kan., north to the Nebraska state line, and which has an office at Plainville, is reported recently to have given a contract to the W. C. Ross Company, of Chicago, to build the line. It is said that sub-contracts for grading will shortly be let. (March 15, p. 384.)

LOUISVILLE & NASHVILLE.—The work carried out by this company since January 1 of this year is as follows: Revision of line, Knoxville division, Corbin, Ky., to Saxton, Ky., 1.60 miles; revision of line, Henderson division, Greenbrier, Tenn., to Guthrie, Ky., 1.80 miles; Meadow Spur, Knoxville division, 1.30 miles; Chenoa branch extension, 1.82 miles; Skelton Creek extension, 6.25 miles, mine spurs, 3.33 miles. Extensions under way: Savoy, Ky., to coal mines, 19 miles; Mount Pleasant, Tenn., to Mayfield, Tenn., 17 miles; completion of work of revision of line, Greenbrier, Tenn., to Guthrie, Ky., 25.70 miles; revision of line, Kentucky division, Corbin, Ky., to Livingston, Ky., 31.70 miles.

MEXICAN ROADS.—The concession granted to W. C. Palmer to build railroads in the state of Zacatecas, Mex., has been modified to include a line from a point between Gutierrez and Canitas, on the Mexican Central, west to Sombrerete, 60 miles. Surveys must be started within two months and the work finished for 30 miles within 18 months. Permisson has also been granted to build a line from Sombrerete, or a point on the above line, south to Chalchihuites, 35 miles, on which surveys must be started within six months, and the line finished within four years. The other stipulations of the concession as originally granted remain in force. (March 15, p. 396.)

MISSISSIPPI ROADS (ELECTRIC).—A company is being organized with a capital of $90,000 in Mississippi to build an electric line from Scranton northeast via Orange Grove and St. Elmo, Miss., and Grand Bay, Ala., to Mobile, about 40 miles. The proposed line will parallel the Louisville & Nashville for most of the way. M. J. McDermott, S. Lowenstein, of the Bank of Mobile; J. D. Willoughby and R. C. Harris, of Scranton, are interested.

PENNSYLVANIA.—An additional section of the Kensington branch of this road in northeast Philadelphia, which now extends from Frankford Junction to Front and Narrow streets, 2.9 miles, is to be elevated, contract for the work having recently been let to the James McGraw Co. The work includes raising three tracks over six streets. It is expected to have it finished next spring, when additional contracts will be let. The track elevation, which will cost when completed about $2,500,000, was begun in 1900 and continued to a point south of Venango street and then discontinued for about four years pending negotiations with the city. The city is to pay $900,000 towards the cost of the work.

This company, it is said, will spend $1,500,000 in the construction of a new yard at Williamsport, Pa. The new yards will be adjacent to the large yards of the Philadelphia & Reading and the New York Central, and also the new yards of the Susquehanna & New York.

PENSACOLA, ALABAMA & WESTERN.—Bids are wanted by the Interstate Contract Co., 224 Brent building, Pensacola, Fla., for grading, masonry and bridges on 105 miles of railroad as mentioned on advertising page 22. At a meeting of the promoters of this company and the Pensacola & Northeastern the bids recently submitted by contractors to grade 20 miles of roadbed of each of these proposed roads were rejected. The work for which bids are now asked includes grading all of the Pensacola & Northeastern from Pensacola, Fla., to Andalusia, Ala., 85 miles, and also for 20 miles on the Atmore division of the Pensacola, Alabama & Western. (June 28, p. 949.)

PENSACOLA & NORTHEASTERN.—See Pensacola, Alabama & Western.

ST. LOUIS & SAN FRANCISCO.—Announcement is made that the Fort Worth & Rio Grande is to be extended from Brady, Tex., south-

east to San Antonio, about 150 miles; and that a west branch is also to be built from Brady to San Angelo, about 60 miles. Surveys reported made.

Southwestern Railway.—Application is to be made in Texas for a charter by a company being organized by Uriah Lott, with office at San Antonio. The promoters propose to build a line from Kingsville, Tex., on the St. Louis, Brownsville & Mexico, north to San Antonio, about 150 miles.

Sugarland Railway.—This company, which now operates 15 miles of road from Arcola, Tex., to Sugarland, will, it is said, build an extension north to Hempstead, about 45 miles. The road is ultimately to be extended north to Fort Worth or Dallas, 200 miles.

Texas Roads.—The Stone & Webster Syndicate, of Boston, Mass., according to local reports, has under consideration the question of building an interurban electric line from Austin, Tex., south to Lockhart, about 30 miles. Surveys have been made and most of the rights of way secured. Power is to be supplied from the works at the Colorado river of the Consolidated Construction Co., of New York.

Union Pacific.—Work has been resumed on the Athol Hill cut-off south of Cheyenne, Wyo. Starting on the main line of the Union Pacific between Denver and Cheyenne, near Carr, Colo., the cut-off is to run northeast to Borie, Wyo., connecting with the main line through Wyoming, 9½ miles west of Cheyenne. A branch leaves the main line between Carr and Borie three miles south of Corlett, connecting with the Wyoming division 4½ miles west of Cheyenne. The total length of the new lines under construction is 17 miles, and the saving in distance between Denver and Borie and points west by the cut-off is over 13 miles. Maximum grade on the present line between Carr and Cheyenne is 1.8 per cent. in both directions. This grade by the new line is cut down to 1.2 per cent. north or westbound, with no adverse grades south or east. The troublesome curves of the present line are also avoided. It is expected to have the cut-off completed and in operation this year. There will be 220,000 cu. yds. of roadbed excavation, about 30,000 yds. of which is solid rock, and 900,000 cu. yds. of embankment. The largest fill is 2,700 ft. long and 45 ft. high. Bridging on the new line consists of concrete arches, cast iron pipe culverts and pile trestles of 5, 8 and 10 spans. The longest arch is 135 ft. There will be three new stations on the line.

Wisconsin Central.—The suit between the Wisconsin Central and the Milwaukee Southern over the right of way in the Menominee valley has been withdrawn by the Milwaukee Southern, and the Wisconsin Central can now build into Milwaukee. The Milwaukee Southern had a franchise from the city council for entrance into Milwaukee, but it was unable to raise sufficient capital to carry out the project. Condemnation proceedings started and won by the Milwaukee Southern have been dismissed.

Wolfe, Megantic & Lotbiniere.—This company, which was chartered to build a line from Lime Ridge, Wolfe county, Quebec, north about 100 miles, has surveys made from Lime Ridge to Lyster, 60 miles. An officer informs us that nothing has been done towards constructing the line. W. H. Lamby, Inverness, Que., Secretary. (March 15, p. 396.)

RAILROAD CORPORATION NEWS.

Alabama Terminal Company.—See Atlanta, Birmingham & Atlantic.

Atlanta, Birmingham & Atlantic.—The Alabama Terminal Company, which represents the Atlanta, Birmingham & Atlantic in the Birmingham district, has increased its capital stock from $2,000,000 to $3,000,000 and is to issue $4,000,000 bonds.

Central of Georgia.—Since the sale of this road in June to Oakleigh Thorne and Marsden J. Perry there has been considerable agitation by holders of the first, second and third preference income bonds who fear that interest payments on these bonds will be sacrificed to the further building up of the road. A bill has even been introduced into the legislature of Georgia, now in session, providing that the income bond holders shall have the same voting rights as stockholders. It is said that the income bondholders may be given the chance to exchange their securities for fixed interest bonds.

Erie.—A plan is said to have been discussed by the directors for paying the dividend on Erie preferred stocks in scrip. At present prices Erie second preferred returns nearly 12 per cent. to the investor.

Georgia & Florida.—The capital stock of this company, a consolidation of a number of small roads in Georgia and Florida, controlled by John Skelton Williams, has been increased from $1,000,000 to $8,750,000, of which $3,500,000 is preferred stock and $5,250,000 common stock.

Grand Trunk.—The dividend on the third preference stock has been passed. Three per cent. was paid from the 1906 earnings.

Houston Belt & Terminal.—The Houston Belt & Terminal Railway has filed a mortgage securing $5,000,000 first mortgage 5 per cent. bonds. The mortgage covers property in Houston to be used for passenger and freight terminals. This company is controlled by the Gulf, Colorado & Santa Fe, Trinity & Brazos Valley (Colorado & Southern-Rock Island Company), St. Louis, Brownsville & Mexico, and Beaumont, Sour Lake & Western (Colorado Southern, New Orleans & Pacific).

Interborough Rapid Transit.—Both tubes of the so-called Belmont tunnel from East 42d street to Long Island City have been joined. It was announced during the course of the investigation of the New York city transit lines now under way by the Public Service Commission of the First district that the Interborough Rapid Transit Company owns this tunnel.

Nashville, Chattanooga & St. Louis.—Gross earnings for the year ended June 30, 1907, were $12,238,472 against $11,120,982 in 1906. Operating expenses increased more than gross earnings, leaving net earnings $2,508,311 in 1907 and $2,766,069 in 1906. Surplus, after interest, taxes and rentals, was $713,980 against $971,537 in 1906.

New York Central & Hudson River.—The operating ratio in the quarter ended June 30, 1907, was 76 per cent., which compares with 83 per cent. in the preceding quarter. Gross earnings for the quarter and six months ended June 30, 1907, were as follows:

For the Quarter.			
Earnings	$25,142,126	Inc.	$3,555,155
Expenses	19,197,643	"	3,869,492
Net earnings	$5,944,483	Dec.	$314,337
Other income	2,551,561	Inc.	898,008
Gross income	$8,496,044	Inc.	$583,671
First charges and taxes	5,768,170	"	235,416
Available for dividend	$2,727,874	Inc.	$348,255
Quarterly dividend, 1½ per cent.	2,679,480	"	814,507
Profit	$48,394	Dec.	$466,252
For Six Months.			
Earnings	$46,930,896	Inc.	$4,051,671
Expenses	37,400,514	"	6,624,601
Net earnings	$9,530,382	Dec.	$2,572,930
Other income	4,911,076	Inc.	1,665,842
Gross income	$14,441,458	Dec.	$907,088
First charges and taxes	11,494,091	Inc.	438,512
Available for dividend	$2,947,367	Dec.	$1,345,600
Semi-annual dividend, 3 per cent.	5,358,960	Inc.	1,629,015
Deficit	$2,411,593	Inc.	$2,974,615

New York Central Lines.—Gross earnings for the month of July, 1907, were as follows:

New York Central & Hudson River	$8,769,318	Inc.	$1,040,096
Lake Shore & Michigan Southern	3,804,876	"	220,445
Lake Erie & Western	398,485	Dec.	34,754
Chicago, Indiana & Southern	235,225	Inc.	69,147
New York, Chicago & St. Louis	809,256	"	534
Michigan Central	2,386,844	"	267,872
Cleve., Cin., Chic. & St. Louis	2,312,464	"	169,099
Peoria & Eastern	234,676	Dec.	9,960
Cincinnati Northern	84,136	Dec.	4,216
Pittsburg & Lake Erie	1,433,695	Inc.	117,923
Rutland	286,276	Inc.	36,352
Total	$20,755,251	Inc.	$1,872,538

New York, Ontario & Western.—Gross earnings for the year ended June 30, 1907, were $8,202,361 against $7,265,058 in 1906, an increase of $937,303. Operating expenses increased $411,059, leaving net earnings of $2,558,015, an increase of $526,244. The surplus after charges was $1,654,782, larger by $467,281 than in 1906.

Northern Pacific.—For the month of July the estimated freight earnings were $4,816,901, an increase of 19 per cent. over the same month in 1906; passenger earnings, $1,885,006, an increase of 36½ per cent., and gross earnings, $6,955,407, an increase of $1,266,481, or 22 per cent.

Pere Marquette.—Subscriptions to the $5,000,000 five-year 6 per cent. notes, issued as part of the reorganization plan, have been received from over 90 per cent. of the preferred stockholders.

Southern Pacific.—The gross earnings of the Southern Pacific Company for the year ended June 30, 1907, were $124,942,527 against $105,632,550 in 1906. There were 9,350 miles operated last year, against 9,192 in 1906. Net earnings over expenses and taxes were $41,825,598 against $35,047,361 in 1906. Thus the increases for the year were as follows: Gross earnings, $19,300,000; expenses and taxes, $12,500,000; net earnings, $6,800,000. Gross earnings for June, 1907 (9,432 miles operated), were $11,082,899, an increase of $1,852,252. The increase in expenses and taxes was almost as large, leaving net earnings over taxes of $2,641,391 against $2,530,469 in 1906.